INTERFACE

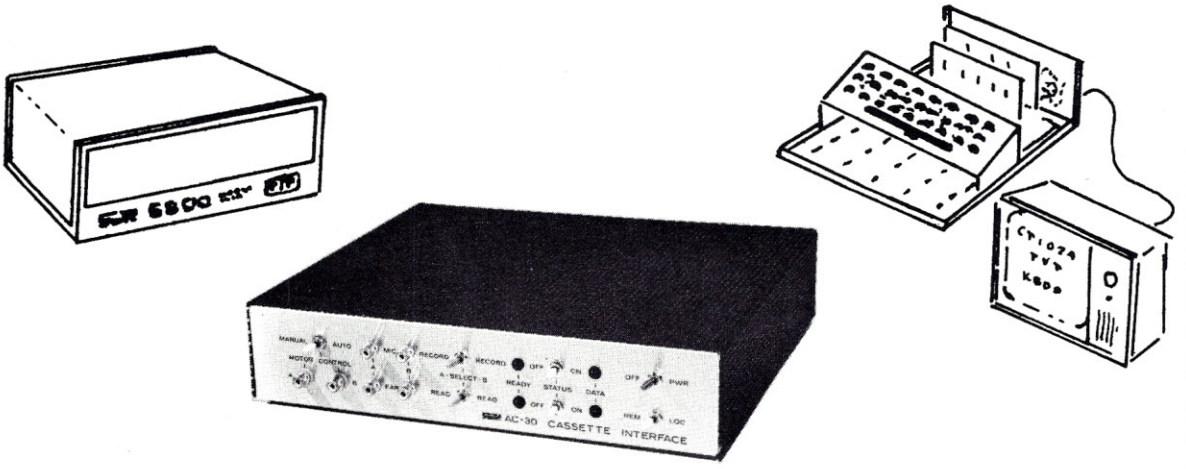
sccs/published for the home computerist/vol. 1, issue 7, june 1976 $1.50

the star trek game – computers take on the klingons

software choices for the star trek game

creative trekking

SUPPLIES THE MISSING LINK
AC-30 CASSETTE INTERFACE



Been looking for a practical way to input and dump programs to your computer? Well your search is over.

With our new AC-30 Cassette Interface you will be able to store and input program data to any computer system having RS-232 serial interfaces and a UART circuit having an accessible 16X clock frequency. Data format is the "Kansas City" standard which was selected for its tolerance of speed variations in the recording device. The AC-30 may be used with any cassette recorder of reasonable quality.

If both your computer and terminal have accessible 16X UART clocks and will operate at 300 baud—as do our 6800 computer and CT-1024 terminal system—the AC-30 may be used between the terminal's serial interface and the computers control interface. This eliminates the need for a separate interface to drive the cassette unit. It also allows you to use the computer system's tape load and dump routines built into Mikbug® or similar ROM software.

Independent control circuits are provided for two audio cassette recorders (not included in the kit). One recorder's tape may be read while the second is recording a new updated tape; making it possible to generate new program tapes, data tapes and to create program object tapes while reading and assembling program source tapes. The operating mode for each recorder is selected by switches on the front panel and LED indicators show the mode that is selected at any particular time. Computer controlled record, play and motor control commands may be used with this system if they are available from the terminal being used. This feature is available on our CT-1024 terminal if the CT-CA cursor control card is installed.

The AC-30 is housed in a 12¾" x 3" x 12½" aluminum chassis. It is powered by a self contained 115/230 Volt AC 50-60 Hz power supply. Data is FSK format using 1200 Hz and 2400 Hz at a 300 baud data rate. Recorder speed tolerance need be only ± 20%.

® Trademark Motorola

AC-30 Cassette Interface Kit $79.50 ppd

Southwest Technical Products Corporation

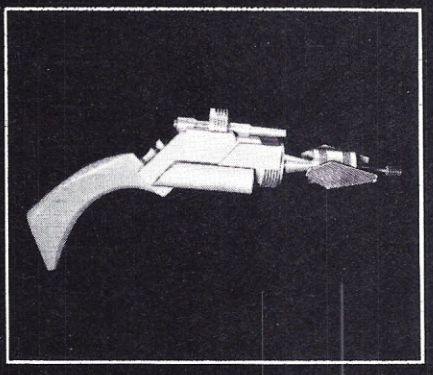
219 W. Rhapsody

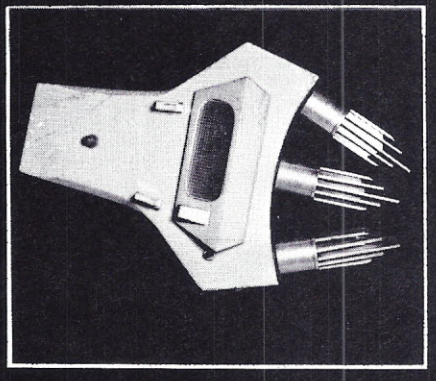
San Antonio, Texas 78216

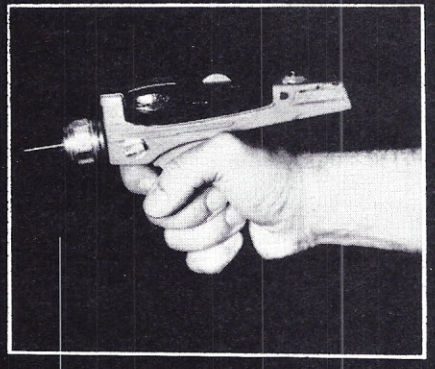
CIRCLE NO. 1 ON INQUIRY CARD

INTERFACE

SCCS/PUBLISHED FOR THE HOME COMPUTERIST VOL 1 / ISSUE 7 / JUNE 1976







THE NATIONAL PUBLICATION OF THE SOUTHERN CALIFORNIA COMPUTER SOCIETY.

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PUBLISHERS STATEMENT

Interface magazine is published monthly by McPheters, Wolfe & Jones, 6515 Sunset Blvd., Suite 202, Hollywood, Calif. 90028. Subscription rate $1.00 with membership in Southern California Computer Society.

All editorial content and effort are contributed at no cost to the Society. Opinions expressed in by-lined articles do not necessarily reflect the opinion of this magazine or the Southern California Computer Society. Mention of products by trade name in editorial material or advertisements contained herein in no way constitutes an endorsement of the product or products by this magazine or by the Southern California Computer Society.

Application to mail at second-class postage rates is pending at Los Angeles, California 90051 and at additional mailing offices.

POSTMASTER: Please send change of address form 3579 and undelivered copies to: Southern California Computer Society, P.O. Box 3123, Los Angeles, CA. 90051.

DIRECT ALL ADVERTISING INQUIRIES TO: Bruce Berkey, National Sales Manager, Advertising Department, SCCS INTERFACE, 61 South Lake Avenue, P.O. Box 4566, Pasadena, California 91106—(213) 795-7002. Steve Richards, Advertising Representative; Zach Bovinette, Director, Retail Circulation.

INTERFACIAL

by Art Childs

IN THIS ISSUE

For maximum utilization of magazine space for relevant material, the editor will occasionally make the sacrifice of ignoring his penchant for verbosity. This is one of those occasions.

Happy Star Trekking.

STAR TREK AND OTHER GAMES

Those of us who work with computers all day eventually yearn to make computers a fun thing—a relaxation device rather than a professional challenge. We suspect it was just such a yearning that initiated the writing of "Star Trek," the most widely used of computer games. And it was probably that same yearning which prompted Lynn Cochran to adapt it to Altair 8K Basic. We believe Lynn's "Star Trek" is not only a fun computer game, but is a good study in effective use of the Basic Interpreter.

TAPE CASSETTE FORMAT STANDARDS

Standards is the subject of discussion in Charles Eby's article. Cassette tapes which are rapidly gaining on paper tape as the most used external mass storage medium by hobbyists, require our attention now to facilitate easy software exchange in the future. Toward that goal, Mr. Eby offers some excellent suggestions for format standards.

INTERRUPTS—RECOGNITION OF REAL-TIME EVENTS

Perhaps one of the most exciting aspects of microcomputers is the applications that allow the machine to respond to external events as they happen, and, as a result, affect the very environment in which the event is taking place. Intelligent intrusion alarms, multiterminal games, voice recognition, event timing, and many other applications require stimuli for the machine from the outside world in the form of *interrupts.*

In the final portion of his series, Terry Benson discusses the whys and hows of the use of interrupts in the 8080 based machine.

READING REFERENCE

We're expanding our "Book Review" section to include publications of interest that take form in magazines, journals, game listings and whatever crosses our path that we think you'd like to know about. We'll also be listing retailers and publishers who can make these publications available to you. If you come across material that would interest hobbyists, please share them with us.

UPDATE

"Update" takes on a new look with this issue. There's too much happening around the country to continue our concentration in Southern California. So you'll be seeing a calendar column, club listings, SCCS chapter listings and announcements of future events. Everyone is invited to announce their club meetings, class offerings, seminars and special events for publication. Please remember though, INTERFACE needs your information at least six weeks prior to publication date.

THE SOUTHERN CALIFORNIA COMPUTER SOCIETY

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Louis G. Fields ..... Vice President
Don Tarbell ..... Secretary
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OBJECTIVES AND PUBLICATIONS

A non-profit organization whose purpose is:
A. To exchange and disseminate information among the Society members concerning the computer arts and sciences.
B. To provide a technical assistance to other members of the Society in those computer projects which are not undertaken for pecuniary gain or profit including but not limited to hardware, software, and computer programming.
C. To publish books, newsletters, magazines, and other periodicals for the benefit and education of the Society members and the general public.
D. To control and sponsor seminars, lectures, and courses relating to the computer arts and sciences.
F. To develop and maintain computer centers and laboratory workshops for the members of the Society and the general public including provisions for time-sharing operations.
SCCS INTERFACE, the official publication of the Southern California Computer Society is published monthly. Its content is composed primarily of articles contributed by members of the Society and intended for the reader with an interest in computers for professional or avocational reasons.

MEMBERSHIP

Membership in the Society is open to anyone, regardless of educational background or geographic location. All members are entitled to the rights of meetings, elections, receipt of official publications in a timely manner, and all other benefits as provided by the officers, Board of Directors, and various committees of the Society pursuant to the by-laws of the Southern California Computer Society.

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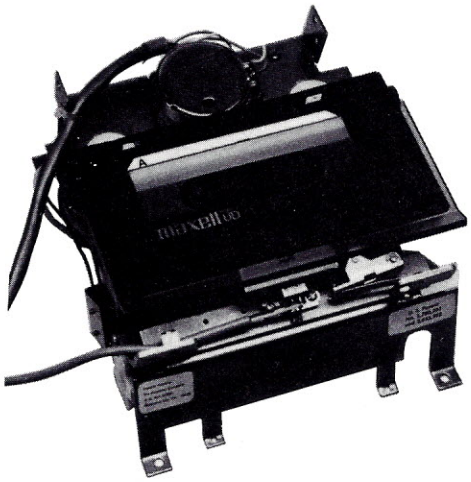
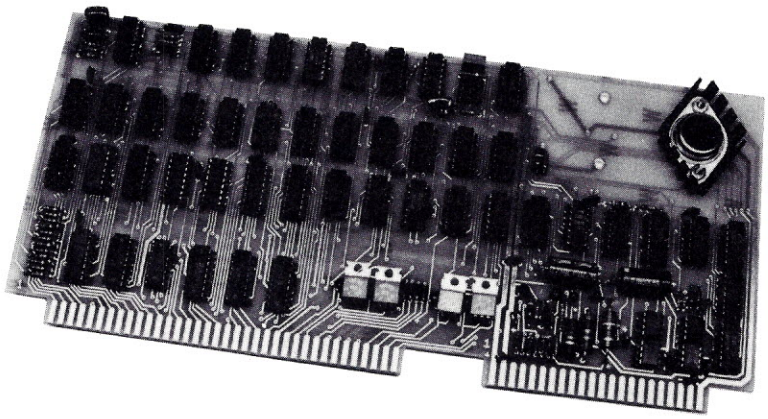
They must be accompanied by return postage and we assume no responsibility for loss or damage thereto. Any material accepted is subject to such revision as is necessary in our sole discretion to meet the requirements of this publication. The act of mailing a manuscript and/or material shall constitute an express warranty by the contributor that the material is original and in no way an infringement upon the rights of others. Send all contributions to: Art Childs—Editor, 335 North Adams, Suite 210, Glendale, Ca. 91206.

1,000,000 BYTES ON-LINE!





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Tape Speed: 5 inches per second
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Cassette Drive is an enhanced Phi-Deck with a digital head, cast head bar, stronger capstan, and four-foot cabling.

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8080 based — 650 bytes
Error Detection: CRC
Retries after soft errors
Automatically bypasses hard errors
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- ○ Read 1 block
- ○ CRC check
- ○ Fast reverse
- ○ Fast forward
- ○ Search for block

For more information, drop us a line or call . . . but by all means, get on our mailing list.

Prices: Interface — full kit PHI-F . . . . . $135 ppd
Each Drive — assem. PHI-1 . . . . . $115 ppd

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(303)861-1686

CIRCLE NO. 2 ON INQUIRY CARD

UPdate

June Meeting—June 26, 1976, 10:00 am to 4:30 pm

Location: Scottish Rite Temple, 4357 Wilshire Blvd., Los Angeles, located between Lucerne and Plymouth, four blocks west of Crenshaw.

Parking: Two levels of parking are available . . . 75¢ all day.

July Meeting: July 24th, same time and location as the June Meeting.

SCCS hopes that everyone who is actively interested in, or remotely curious about home computing is able to call upon fellow hobbyists for assistance, new ideas, and community project participation . . . regardless of where they live. So we have gathered a brief list of computer groups around the country which are either formally organized or hopeful of doing so. The clubs are listed alphabetically by city. So look for your home town and see if you can locate others in your area to share your fetish. Then check the calendar of events to see when it's happening. If you don't see an organization listed in, or near your city, maybe you'd like to start one. If you have a club and we somehow missed you, we're sorry! But let us know you're out there. Address your announcements to Editor, INTERFACE Magazine, 335 N. Adams St., Glendale, Calif. 91206.

CALENDAR OF EVENTS

June 2—San Fernando Valley Chapter Meeting. 7:15 p.m. at the Harvard School, 3700 Coldwater Canyon Road, North Hollywood. Contact John Scott (213) 849-4094.

June 7-10—National Computer Conference, New York City. For information contact Dr. Carl Hammer, General Chairman, Univac, 2121 Wisconsin Ave., N.W., Washington, D.C. 20007 or AFIPS, 210 Summit Ave., Montvale, N.J. 07645.

June 8—Santa Monica Bay Chapter Meeting. Contact Larry Press, 128 Park Place, Venice, Ca. 90291 for more information.

June 11-13—Compfest sponsored by the Cleveland Digital Group. Contact Gary Coleman for more information. (216) 777-3543. 14058 Superior Ave., #8, Cleveland, Ohio 44116.

June 11-13—Midwest Regional Computer Conference, Summerset Inn, Cleveland, Ohio. Sponsored by Midwestern Affiliation of Computer Clubs. Features seminars and workshops. Contact Gary Coleman, P.O. Box 83, Brecksville, Ohio 44141.

June 16—SCCS Meeting of the Board of Directors. 7:30 p.m. at the Harvard School, 3700 Coldwater Canyon Rd., N. Hollywood.

June 23-25—Microcomputer Interfacing Workshop. Concentration on 8080 microprocessors. Contact (703) 951-6328, Blacksburg, Virginia.

June 26—SCCS General Membership Meeting 10:00-4:30 p.m. Scottish Rite Temple. 4357 Wilshire Blvd., Los Angeles. For information call (213) 472-0388.

June 29—San Gabriel Chapter Meeting. 7:30 p.m. at Pasadena Central Library auditorium, 385 E. Walnut St. at Garfield Ave.

June 29-July 1—Seminar "Interfacing with the Microprocessor" 9 a.m. to 5 p.m. at Ramada Inn in Culver City, California. Sponsored by Edwards Associates and E & L Instruments. For information contact Allen J. Edwards (213) 377-0975.

July 20-22—Seminar "Interfacing with the Microprocessor" repeat of June 29th program.

September 23-25—Microcomputer Interfacing Workshop based on 8080 microprocessor in Blacksburg, Va. Contact Dr. Norris Bell, VPI, and S.U. Continuing Education Center, Blacksburg, VA. 24061 (703) 951-6328.

SCCS CHAPTER DIRECTORY

San Fernando Valley Chapter meets the first Wednesday of each month at 7:15 p.m., Harvard School Cafeteria, 3700 Coldwater Cyn., N. Hollywood. For more information, contact John Scott, Chairman at home (213) 849-4094, or Dave Resnick (213) 670-4698.

San Gabriel Valley Chapter will meet June 29th at 7:30 p.m. at Pasadena Central Library Auditorium, 385 E. Walnut St., at Garfield. For membership and location information, Write c/o SCCS, P.O. Box 9459, North Hollywood, Calif. 91609. Please include a stamped, self-addressed envelope for your reply.

South East Computer Group regular meetings are the first Thursday of the month at the South Gate Public Library, 4035 Tweedy, 6:30-9:00 p.m. For information call (213) 566-1677.

Santa Monica Bay Chapter contact Larry Press, 128 Park Place, Venice, Ca. 90291.

Ventura County Computer Society meets Saturday, June 26th, 9:30 a.m. at the Camarillo Library, 3100 Ponderosa Drive. For information, write P.O. Box 525, Port Hueneme, Calif. 93041.

CLUB DIRECTORY

(listed alphabetically by city)

Aledo, TX.
Texas Computer Club
Rt. 1, Box 272
Aledo, TX. 76008
(L. G. Walker)

Atlanta, GA.
Atlanta Area Microcomputer Hobbyist Club
421 Ridgecrest Rd.
Atlanta, GA. 30307
(Jim Dunion)

Citrus Heights, CA.
Sacramento Minicomputer Users Group
P.O. Box 741
Citrus Heights, CA. 95610

Cleveland, Ohio
The Cleveland Digital Group
c/o Ronald L. Herff
14058 Superior Ave., #8
Cleveland, Ohio 44116
(216) 777-3543

Cleveland, OH.
Universe Unlimited Users Group
11918 Forest Ave.
Cleveland, OH. 44120
(John E. Kabat)

Cockeysville, Md.
Chesapeake Micro Computer Club, Inc.
236 Saint David Ct., #4
Cockeysville, Md. 21030

Coral Springs, FL.
Southern Florida Computer Club
11080 N.W. 39th St.
Coral Springs, FL. 33065
(Robert Denis)

Denver, Colorado
Denver Amateur Computer Society
P.O. Box 6338
Denver, Col. 80206

Dewitt, MI.
Mid-Michigan Micro Group
13121 Tucker Dr.
Dewitt, MI. 48820
(Wm. J. Serviss)

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- Operators manuals
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El Paso, TX. 79912

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Computer and Electronic
Hobbyists' Assn. of America
43-70 Kissena Blvd.
Flushing, New York 11355

Hampton, VA.
Peninsula Computer Hobbyist Club
2 Weber Ln.
Hampton, VA. 23663
(Larry Polis)

Highland Park, IL.
Chicago User Group
195 Ivy Ln.
Highland Park, IL. 60035
(R. Swartz)

Huntsville, Alabama
North Alabama Computer Club
1409 Blevins Gap Rd., S.E.
Huntsville, Alabama 35802
(205) 859-7344 or (205) 883-7973

Ithaca, N.Y.
Ithaca Computer Group
204 Dryden Rd.
Ithaca, N.Y. 14850
(Steve Edelman)

Jamaica, New York
Long Island Computer Assn.
P.O. Box 864
Jamaica, New York 11431

Los Angeles, CA.
Computer Organization
of Los Angeles
P.O. Box 43677
Los Angeles, CA. 90043

Los Angeles, CA.
UCLA Computer Club
3514 Boelter Hall
UCLA
Los Angeles, CA. 90024

Minneapolis, MN.
Bit User's Association
3010 4th Ave. S.
Minneapolis, MN. 55408

Mountain View, CA.
Homebrew Computer Club
P.O. Box 626
Mountain View, CA. 94042

Nashua, NH.
New England Computer Society
103 Spit Brook Rd. #A12
Nashua, NH. 03060
(Bill Risch)

New York City
New York City Micro Hobbyist Group
c/o Bob Schwartz
1E, 375 Riverside Drive
New York, N.Y. 10025

North Reading, MA.
Boston Area Group
21 Sunset Ave.
North Reading, MA. 01864
(John Vullo)

Oklahoma City, OK.
Oklahoma City Computer Club
2412 SW 45th
Oklahoma City, OK. 73119
(Bill Cowden)

Oxnard, CA.
Ventura County Computer Club
4409 Vinyard Ave.
Oxnard, CA. 93030
(E. Strohbehn)

Peterborough, NH.
New England Computer Club
c/o Byte Magazine
70 Main St.
Peterborough, NH. 03458

Pittsburgh, Pa.
Pittsburgh Area Computer Club
400 Smithfield Street
Pittsburgh, Pa. 15222

Pleasanton, CA.
Bay Area Microprocessor
User's Group
4564 Black Ave.
Pleasanton, CA. 94566

Rochester, MN.
Southeast Minnesota
Amateur Computer Club
2122 NW 17th Ave.
Rochester, MN. 55901

Rydal, PA.
Delaware Valley Chapter SCCS
1228 Barrowdale
Rydal, PA. 19046
(Martin Dimmerman)

San Diego, CA.
San Diego Computing Society
P.O. Box 9938
San Diego, CA. 92109
(J. W. Farschen)

Santa Ana, CA.
HP-65 User's Group
2541 W. Camden Pl.
Santa Ana, CA. 90024
(Rich. Nelson)

Santa Barbara, CA.
Santa Barbara Computer Group
210 Barrunca #2
Santa Barbara, CA. 93101
(Glenn A. McComb)

Scotch Plains, N.J.
Amateur Computer Group
of New Jersey
Sol Libes, President
1776 Raritan Road
Scotch Plains, N.J. 07076
(201) 889-2000, X247 or (201)
277-2063

Seabrook, Texas
NASA—Johnson Space Center
Computer Hobbyist Club
President, Marlowe Cassetti
1011 Devonport
Seabrook, Texas 77586
(713) 474-2923

Seattle, WA.
Northwest Computer Club
P.O. Box 5304
Seattle, WA. 98105

Sheboygan Falls, Wisc.
Wisconsin Area Tribe of
Computer Hobbyists (WATCH)
Attn: Don Stevens
P.O. Box 159
Sheboygan Falls, Wisc. 53085

Tallahassee, FL.
Tallahassee Amateur
Computer Society
Rt. 14, Box 351-116
Tallahassee, FL. 32304
(Larry Hughes)

Terre Haute, IN.
Beta Iota Tau
c/o Richard A. Retke
R.H.I.T. Box 420
Terre Haute,, IN. 47803

29 Palms, CA.
29 Palms Area Computer Group
74055 Casita Dr.
29 Palms, CA. 92277
(Sgt. Wesley Isgrigg)

Vernon Hills, IL.
Chicago Area Hobbyist Exchange
P.O. Box 36
Vernon Hills, IL. 60061

Virginia Beach, VA.
IBM 5100 Users Club
5541 Parliment Dr., Suite 104
Virginia Beach, VA. 23462
[R. E. Easton, M.D. (804) 490-0124]

Washington, D.C.
Amateur Computer Society
4201 Massachusetts Ave. #168W
Washington, D.C. 20016

Woodland Hills, CA.
Lilton Calculator/Computer Club
5500 Canoga Ave.
Woodland Hills, CA 91364

OUTSIDE USA

Brandon, Manitoba, Canada
Canadian Computer Club
861 11th St.
Brandon, Manitoba, Canada
(G. Pearson) 47A 4LI

Islington, Ontario, Canada
Harold Melanson
1 Richview Rd. #1204A
Islington, Ontario, Canada M9A 4M5

Kingston, Ontario, Canada
Victor Vees
342 Palace Rd.
Kingston, Ontario, K7L 4T3
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Ottawa, Ontario, Canada
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(J. G. Margetts)

Branch to . . . pg. 63

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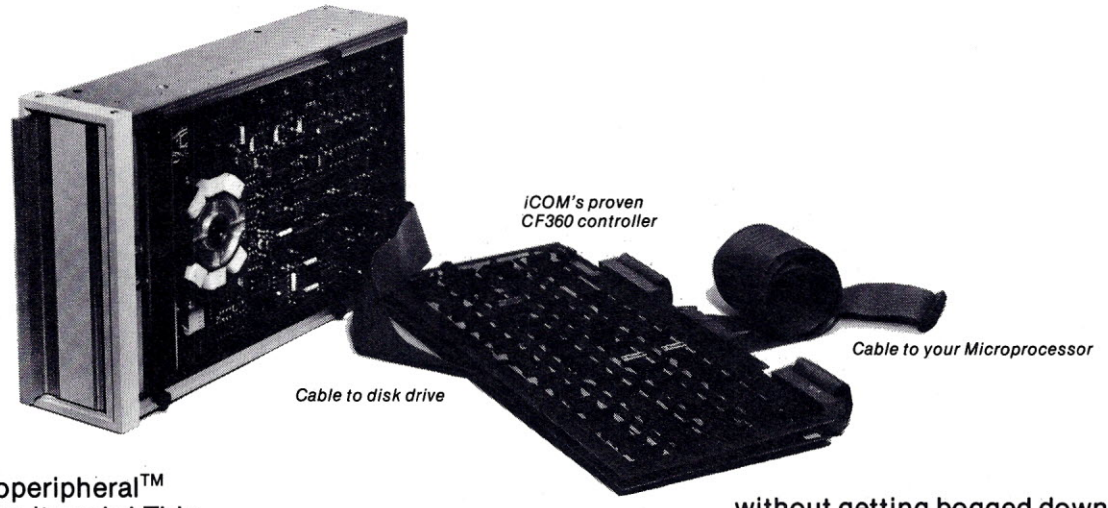

iCOM, the microperipheral™ people have done it again! This time with a ready-to-go Floppy Disk Subsystem for your low budget microprocessor-based project.

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- Interface cable to your microprocessor
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- Disk drive with daisy chain capability
- Controller-to-disk drive cable

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CIRCLE NO. 4 ON INQUIRY CARD

Letters to the Editor

A LETTER TO A NEW BREED OUT THERE

Dear New:

This letter will have to substitute for my promise last month to present notes on writing harmonic algorithms. My friends failed me and I failed my friends; especially the most able one who is in Chicago. Larry Cuba did the programming for my latest film *Arabesque.* He was too busy. The notes that I predicted for this month may yet be printed in the next issue. In the meantime here is a thought for the day:

I know first hand something about the dreams of many many young people who have aspired to shape their careers as independent artists regardless the odds and the hardship. I was among the first group of independent film makers that followed World War II. I have talked with many today and know that they must be legion, these young people around the world here and there who ache to become independent artists; mostly they turn to film. But the costs—lab equipment, film, etc.—for independent film making are rapidly moving out of sight. Coincidentally, the costs of computer graphics are moving in exactly the other direction. With this extraordinary economic twist alone, not considering many other factors, I find it easy to foresee an era about to burst upon us when cinema will take second place to another kind of motion and sound visual art. This will be an era with a new kind of action and color and design and music generated with low cost computers. A new generation of inventor artists will display their creations on standard color television. I am sure this eventually will become a major turning point toward rescuing and democratizing that monopolized boob tube which otherwise holds such unrealized potential for eye and ear.

John H. Whitney

Dear Hardware Editor

"We need a FAST access cassette or other tape memory. As for me, I will use the MITS EXT. BASIC cassette. After that I will be using std. ½" computer tape with two tracks in this format: Track one or "A" will be program or data; track two or "B" will be file number (binary) type data or program beginning and end of file possible file size check sum, etc. . . . This tape drive will be fully computer operated by keyboard control or program control. Data will be put on the tape at about 600 bpi. Now you may ask what this is all about, or answer what we need is a complete servo-computer controlled drive system for data storage to be effective.

T. Bailey
11717 N.E. 143 St.,
Kirkland, Wn. 98033

Dear T. Bailey:

Cassette or any other type of tape memory system will probably never be classified as fast access unless we have a technological breakthrough, and the technical advances that are coming would seem to be headed in other directions, such as magnetic bubble memories. As far as using a two track recording scheme, why not put it all on one track and minimize some of the problems that could exist with two read heads, two amplifiers etc. The information about file size and file name as well as where the file is to be loaded into memory can be put in a preamble block of the tape just prior to the file block. Similarly a post file block can follow the main data or program block and contain any desired check features. Using a scheme such as this would effectively double the tape's storage capacity. The idea of a servo type tape transport that would allow complete computer control is a good idea that can allow file searches, copying and sorting, but file sorting can require more than one transport. One such remote controlled cassette tape transport is made by PHI-DECK, 1901 No. Walnut, Oklahoma City, Oklahoma 73105 and sells for about $100. Tape's OK but I'll take a floppy disc! Lots of luck.

Scott Wilcox
Hardware Editor

Dear Mr. Childs:

Could you tell me how to order, where and how much the book "Game Playing with Computers" by Donald D. Spencer. An excerpt from the book appeared on pages 40 and 41 of your February 1976 issue. Any help or information would be greatly appreciated

R. W. Brown
Utica, New York

Dear R. W.:

The book is a Spartan Book and is distributed by Hayden Book Co., Inc., 50 Essex St., Rochelle Park, N.J. 07662 (now in it's 2nd edition). Jon could not recall where he'd purchased the book, but suggests you write PCC in Menlo Park, Calif., or check with one of the local computer stores, or any good well-stocked book store. It's worth hunting for!

Editor

Dear Mr. Childs:

I wish Jon Walden ("Slot Machine Game for MITS BASIC," February, 1976) actually built slot machines for the casinos. The first two number of possible ways should be 1120 and 480 rather than 400 and 240. This raises the payoff to the point that the player has a 30.1% advantage.

A. J. Nichols, Manager
Microcomputer Applications
Intel Corporation, Santa Clara

Dear Mr. Nichols:

John Walden retorts, "You'll find the numbers I used on page 222 of Spencer's book. All I did was run his math through the wringer. (Actually, I thought I was coming out pretty lucky; maybe we can get Donald to build the slot machines!) You were generous to criticize only two numbers out of the whole page of questionable programming! I had sort of hoped to challenge all of you to come up with better stuff; maybe I should have written a Basic version of 'Fool On The Hill' . . . "

Editor

COMMENTS & SUGGESTIONS FROM THE READERS ON STANDARDS

As they arrive, reader's letters and contributions regarding STANDARDS will be printed. Initially these contributions will appear in a special section of "Letters To The Editor." When that courageous individual steps forth who will ultimately become Standards Editor, material of this nature and the editor's comments will appear in a special STANDARDS column.

Dear Editor:

This is in response to the more-or-less recent proposal by Scott Wilcox regarding a convention for software to be used with the new hobbyist tape

standard sponsored by Byte Magazine.

Using the 35th and 36th words on the tape for a count of the number of bytes recorded is unnecessary. A better use would be to indicate the low and high bytes of the stop address. Why should the programmer or his program have to keep track of the number of bytes recorded, when the stop address of the data is already known at the time the recording is made.

Also, use of the ASCII "ETX" byte is not strictly necessary with either software convention, but it does serve as a double-check on correct loading.

Regardless of the final choice, we must come to an agreement on this question as soon as possible. Standardization of software is absolutely necessary if we are to reach our goal of easy and convenient interchange of software. If we don't use the same software and hardware, there's no sense in trying to exchange anything.

Samuel H. Daniel
Vandenberg AFB, Ca.

Dear Editor:

I agree with Mr. Wilcox (SCCS INTERFACE, Vol. 1, #2, 1976, letter on p. 43) that initiatives should be taken to standardize computer data exchange. It appears, however, that Mr. Wilcox overlooked the importance of terminating the SYN stream with a pre-assigned standard character. Under worst-case conditions all four entries following the last true SYN character could themselves be 026 octal (i.e., SYN code). Although software recovery is possible, a standard format should avoid this. I submit as an alternative the Computers Users Exchange Standard (CUES). This contains the essence of the Wilcox proposal but more precisely defines the role of the heading. Differences from the "Popular Electronics" HIT format are as follows:

1. Limit SYN stream to not more than 127 characters.
2. Terminate SYN stream with SOH.
3. Define a formal heading of 2 bytes text count and 2 bytes address pointer.
4. Allow an informal extended heading which excludes STX characters.
5. Exclude text count from body of text.

The purpose of item #1 is to facilitate a one-byte count of sync cycles which cannot go "negative." My own use of this is to increment a counter in the sync loop which resets to a negative bias (e.g., −8) on loss of sync and which must register positive when the SOH terminator is encountered. Item #2 could remain STX but ASCII provides the unambiguous SOH ready-made for this situation. Item #3 is the Wilcox addition reordered so that the low-order byte of text count occurs first for those who might choose to ignore the rest. Item #4 allows each author wide latitude in implementing his favorite system of titles, identification codes, flags and what-have-you.

The first four entries in the heading are mandatory although all but the first might remain unused. Standard labels are applied to these four entries; however, only the text count has an exact operational definition at present. Pending further standardization, the function of the address pointer will depend on the author. Often it will represent an absolute loading address (a la Wilcox) but it could be an automatic jump-to-start address, a label, etc. The standard read subroutine must dispose of the four mandatory heading entries, then initiate a search for STX, passing over any informal heading.

We must be careful not to invoke a standard which becomes a software embarrassment. Perhaps the version proposed here is excessive. The minimum format which serves the needs of the community should be adopted, adhered to and promulgated.

James D. Larson
Oak Ridge, Tenn.

Dear Editor:

Though I have been active in Amateur Radio and Electronics for seventy years, I am just getting into COMPUTERS and in that branch I am a real beginner. Since I am retired I have no business address or phone, so . . . I have had the opportunity to look over the march 1976 issue of INTERFACE and it looks like you have the makings of a national society . . . I would like to be part of it.

Clifton T. Nichols
77-014 California Dr.
Palm Desert, Ca. 92260

Renaming SCCS

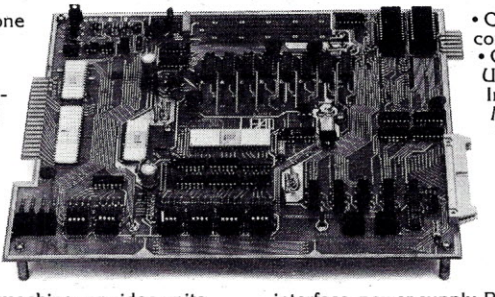
Dear Editor:

Personally, I sort of like the name Intercontinental Byte Manipulators (IBM), but the acronym has been pre-empted—I think. How about Amateur Computer Engineering Society (ACES); that has a nice sound, don't you think? To preserve the logo, the organization could be called the Supra-Continental Computer Society, but that's kind of hard to pronounce.

Sincerely,
Jim Day
Granada Hill, CA.

Branch to . . . pg. 53

If you want a microcomputer with all of these standard features...



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By Larry Press

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BIORYTHMS: Art Childs, 335 N. Adams, #210, Glendale, Ca. 91206 (213) 243-5179
GAMES: George Tate, 3544 Dahlia Ave., Los Angeles, Ca. 90026 (213) 663-2604
MITS BASIC: Jon Walden, 11557 Sunshine Terrace, Studio City, Ca. 91604 (213) 769-6569
ELECTRONIC MUSIC: Prentiss Knowlton, 255 N. Madison Ave., Suite #4, Pasadena, Ca. 91101 (213) 449-6034
VOICE SYNTHESIS: D. Lloyd Rice, 821 Pacific, #4, Santa Monica, Ca. 90405 (213) 392-5230 (hm), (213) 825-2773 (bus).

ELECTRONIC MUSIC

We have volunteer coordinators for two new areas this month—Prentiss Knowlton, who is interested in electronic music and Lloyd Rice who is into voice synthesis.

Prentiss began working with electronic music while a graduate student, and since 1971 has had a pipe organ under control of a PDP-8 at the All Saints Church in Pasadena.

Prentiss is the only computer scientist I know who lists a recording and journal articles on his resume. If you're interested, you can get a copy of his record, "Unplayed by Human Hands" from Computer Humanities, 2310 El Moreno St., La Crescenta, Calif. 91214. The record includes works of Mozart, Bach and Scott Joplin. Also included is a piece by the French composer Roger-Ducasse which, due to its difficulty, had never been played since it was written in 1909. The record costs $7 which includes shipping and tax.

I received a paper entitled, "Alpha Numeric Music with Amplitude Control" by Malcom T. Wright. It got me to thinking about computer generated music. Wright's paper describes a program and hardware add-ons for playing tunes on your ALTAIR.

The program is an interpreter and fits into just under 1K. It is driven by the user's "music table" which is an encoding of the tune he wishes the machine to play. Thus the user of Wright's program essentially has a higher level language for describing tunes to be played. For each note in his tune, he can specify duration (6 options), and value in addition to changing tempo (4 options), changing volume (3 options), shifting octaves (6 options) repeating passages, etc. For example, to play a C-sharp, sixteenth note, the user enters "C#S" in the music table. Functions such as shifting octaves, changing tempo, etc. are achieved by using control characters in the music table.

The neat part of a system like this is the simplicity of the peripheral hardware. You need a parallel output port and a D/A converter. If your ALTAIR has no parallel output, Wright shows a three IC schematic (a voltage regulator, 8 bit latch and a comparator) for making one. His schematic is drawn in terms of ALTAIR bus pins so it would be difficult for a beginner to mess up this construction project. The D/A converter is merely a network of 10 resistors, connected to the output port and to an audio amplifier.

If you're interested in obtaining this paper, copies may be purchased from PCC (2) and perhaps copies of the program as well. If the program is not available, Wright's paper contains the complete listing.

If Wright's system sounds like more than you need (sharps, flats, quarter notes, octaves, tempos—who needs 'em), but you would still like to hear your computer make noise, look at Carl Helmers' article in the October '75 BYTE. The peripheral there is a single quad NAND chip and a 5 inch speaker. That's hard to beat for simplicity! Helmers also describes a simple interpreter which has many fewer options than Wright's. Using this program, the user may only specify the pitch and duration of each note in his tune. He can choose from 7 durations and 21 pitches, and this one is written for the 6800.

SPEECH ANALYSIS

Lloyd Rice has been working on speech analysis and processing at the Phonetics Lab at UCLA for the last five years. He and Jim Cooper have designed, and plan to market, a voice synthesis module for microcomputers. The synthesis module is small enough to fit on an ALTAIR board, and allows full control of intonation. Lloyd points out that it is capable of synthesizing *any* human speech sound, and is not restricted to a dull monotone, as are other units. The module is designed for compatability with the popular 8800, the 6800, the 6502, and other chips. They plan to make PC boards for the ALTAIR and other common busses in addition to the synthesis modules.

If you are doing something in either the area of electronics music or speech synthesis, drop Lloyd or Prentiss a line to let them know about your work. You might also send me a copy and I'll put it in the Applications Exchange. If you have questions or need pointers to sources of information, Lloyd and Prentiss will also help you out.

BIOFEEDBACK AND BIORYTHM

Bob Albrecht, publisher of the super periodical, "People's Computer Company," dropped me a note regarding biorhythms and biofeedback. There is a biorhythm program in Bob's book "WHAT TO DO AFTER YOU HIT RETURN." This book is available from the PCC Book Store, and my guess is that PCC also distributes the program on paper tape for a nominal fee. Their address is P.O. Box 310, Menlo Park, Calif. 94025.

Branch to . . . pg. 62

Logic Probe 1 is a compact, enormously versatile design, test and troubleshooting tool for all types of digital applications. By simply connecting the clip leads to the circuit's power supply, setting a switch to the proper logic family and touching the probe tip to the node under test, you get an instant picture of circuit conditions.

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While high-frequency (5-10MHz) signals cause the "pulse" LED to blink at a 3Hz rate, there is an additional indication with unsymmetrical pulses: with duty cycles of less than 30%, the LO LED will light, while duty cycles over 70% will light the HI LED.

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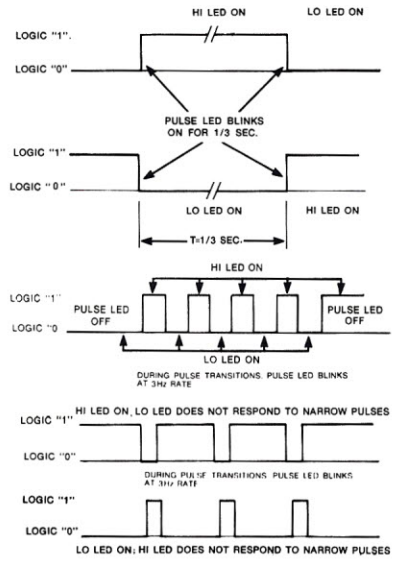
HI LED ON
LO LED ON
LOGIC "1"
LOGIC "0"
PULSE LED BLINKS ON FOR 1/3 SEC.
LO LED ON
HI LED ON
T=1/3 SEC.
PULSE LED OFF
PULSE LED OFF
DURING PULSE TRANSITIONS, PULSE LED BLINKS AT 3Hz RATE
HI LED ON, LO LED DOES NOT RESPOND TO NARROW PULSES
LO LED ON; HI LED DOES NOT RESPOND TO NARROW PULSES

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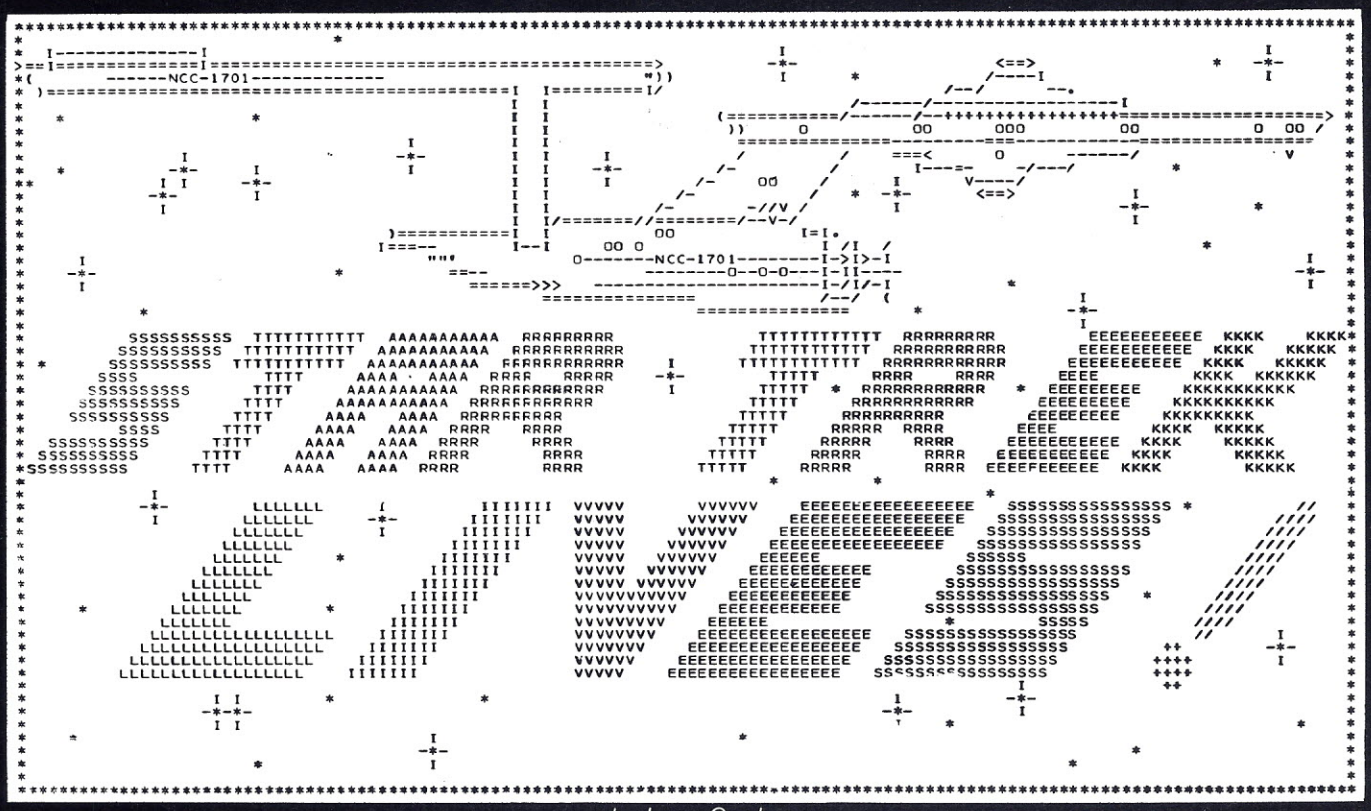


by Lynn Cochran

Lynn Cochran, a graduate of Cal Poly, Pomona has been active in amateur radio including the design of digital controls for repeater systems, and has recently become involved in the hobby computer field. He is presently employed in San Francisco as a communications engineer for a large oil corporation.

The computer game of STARTREK (based on NBC's popular TV show) has appeared in many versions since the late sixties. Among the most popular versions are those written by Mike Mayfield in the HP contributed program library, and by David Ahl in the book 101 BASIC COMPUTER GAMES.

These instructions are for a version of STARTREK optimized for use with MITS 8-K BASIC (a listing of the program is included). I rewrote it to fit in a minimum of memory with the result that it *just* fits in my 12-K Altair 8800 system with the 8-K Basic interpreter (version 3.1). In rewriting it to get it to fit within 12-K, I've combined the "Warp Engines" and "Photon Torpedoes" routines, left out printed-out instructions, and eliminated the "Status Report" command (each device now tells you how many years are required for its repair when you try to use it). It also runs a little slower than on the big machines; it takes about 4 seconds to set up a new Quadrant, and a whole 10 seconds to initialize the Galaxy, but the feeling you get from saving the known universe makes it worth it. Running this program is also a good way to test memory; it finds problems no memory-checker program will (it uses just about everything). It would be a good bet to put your best memory in the bottom 8-K to minimize the fatality of any 'memory-lapses.' The program does not use ATN, so Basic can be initialized without it if memory space is needed.

I have included a 'Block Diagram' of the STARTREK program which provides, on one page, an idea of how the program works. The diagram shouldn't be taken too literally; not shown are the damaged device routines, or the fact that the "Warp Engines" and "Torpedo" commands are processed by a single routine.

Also included is a list of the variables used in the program; they may come in handy if you try to decipher the strange techniques I've used to crunch STARTREK into 12-K of memory.

Because I feel that other people may want access to copies of this program, either to modify for their own use, or to use as is, I want to see this program freely distributed.

Lynn Cochran

INSTRUCTIONS FOR STARTREK

It is Stardate 3421 and the Federation is being invaded by a band of Klingon "pirates" whose objective is to test our defenses. If even one survives the trial period, Klingon Headquarters will launch an all out attack. As Captain of the Federation Starship 'ENTERPRISE,' your mission is to find and destroy the invaders before the time runs out.

The known galaxy is divided into 64 quadrants arranged like a square checkerboard, 8 on a side. Each quadrant is likewise divided into 64 sectors arranged as an 8 by 8 square. Each sector can contain a Klingon (K), star (*), Starbase (B), the Enterprise herself (E), or empty space (.). Each sector is also numbered; a Starbase in sector 3-5 is 3 rows down from the top of the Short Range Scan printout, and 5 sectors to the right. Docking at a Starbase is done by occupying an adjacent sector, and reprovisions your Starship with energy and photon torpedoes, as well as repairing all damages.

Your Starship will act on the following commands:

Command 1—Warp Engine Control is used to move the Enterprise. You will be asked to set the distance (measured in Warps), and the course for the move. Each move that you make with the Enterprise from one sector to another, or from one quadrant to another, costs you one stardate (one year). Therefore, a 30 year game means you have 30 moves to win it in.

Course—A number from 1 to 8.999 indicating a direction (starting with a 1 to the right and increasing counterclockwise). To move to the left, use a course of 5. (A course of 3.5 is halfway between 3 and 4; a course of 8.75 is three-quarters of the way from 8 to 1.)

Warp—One Warp moves you the width of a quadrant. A warp of .5 will move you halfway through a quadrant; moving diagonally across a quadrant to the next will require 1.414 Warps. Warp 3 will move you 3 quadrants providing nothing in your present quadrant blocks your exit. Once you leave the quadrant that you were in, you will enter Hyperspace; coming out of Hyperspace will place you randomly in the new quadrant. Klingons in a given quadrant will fire at you whenever you leave, enter, or move within that quadrant. Entering a course or warp of zero can be used to return to the command mode.

Command 2—A Short Range Sensor Scan will print out the quadrant you presently occupy showing the content of each of the 64 sectors, as well as other pertinent information.

Command 3—The Long Range Sensor Scan summarizes the quadrant you are in, and the adjoining ones. Each quadrant is represented as a 3-digit number; the first (hundreds) digit is the number of Klingons in that quadrant while the middle digit is the number of Starbases, and the units digit is the number of stars. An entry of 305 means 3 Klingons, no Starbases, and 5 stars.

Command 4—Fire Phasers; the portion of the Enterprise's energy that you specify will be divided evenly among the Klingons in the quadrant and fired at them. Surviving Klingons will retaliate. Phaser fire bypasses stars and Starbases, but is attenuated by the distance it travels. The arriving energy depletes the shield power of its target. Energy is automatically diverted to the shields as needed, but if you run out of energy, you'll get fried.

Command 5—Photon Torpedo Control will launch a torpedo on a course you specify which will destroy any object in its path. Range is limited to the local quadrant. Expect return fire from surviving Klingons.

Command 6—The Galactic Records Section of the ship's computer responds to this command by printing out a galactic map showing the results of all previous sensor scans.

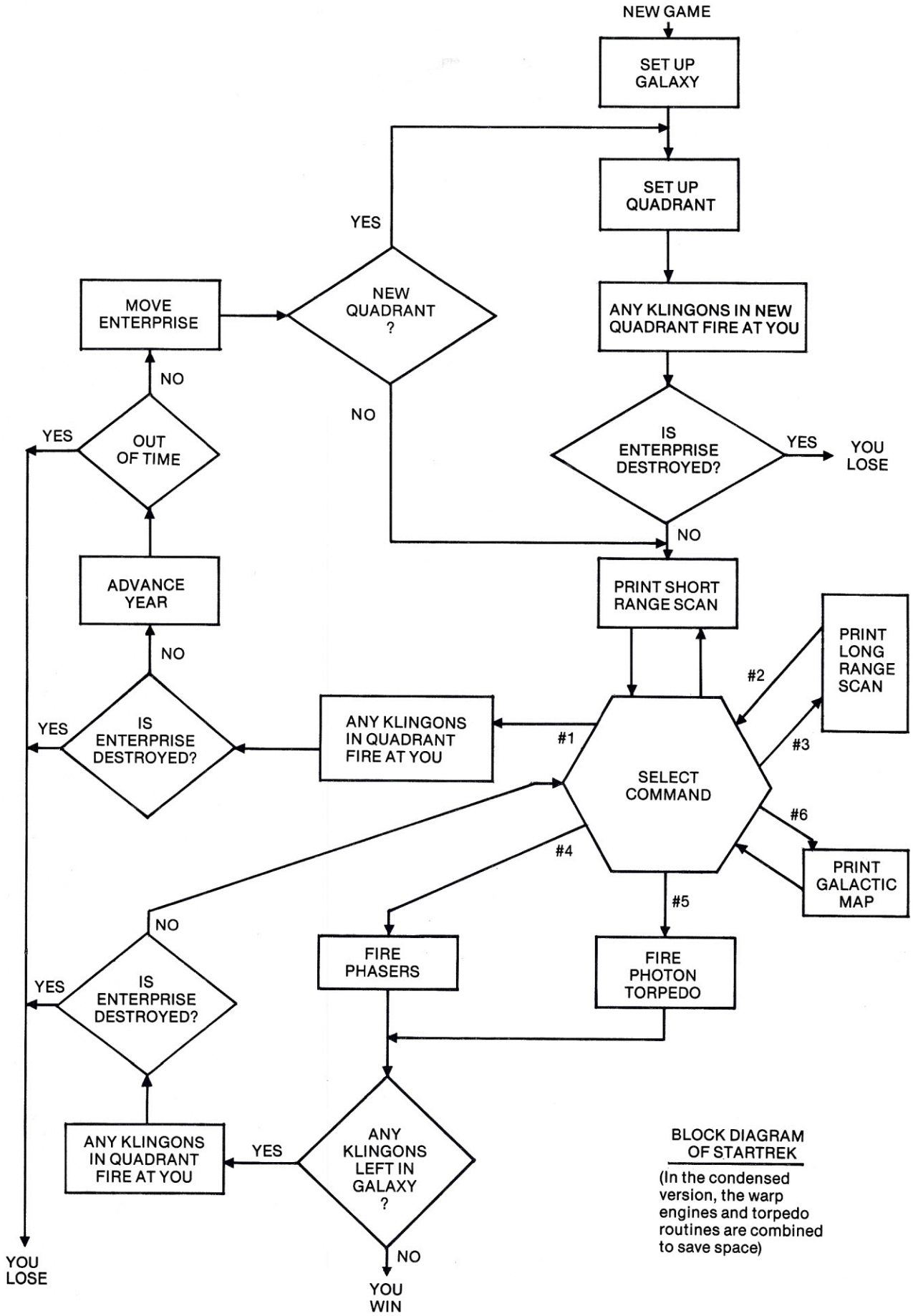
VARIABLES USED
WITHIN THE STARTREK PROGRAM

A = Command:
- A = 0 Just arrived in quadrant.
- A = 1 Warp Engine Control
- A = 2 Short Range Sensor Scan
- A = 3 Long Range Sensor Scan
- A = 4 Phaser Control
- A = 5 Photon Torpedo Control
- A = 6 Print Galactic Map

E = Present energy
E0 = Initial energy
P = Number of torpedoes left
P0 = Initial number of torpedoes
T = Present year
T0 = Starting year
T9 = Ending year
K = Number of Klingons in present quadrant
K9 = Total number of Klingons in the galaxy
B = Number of Starbases in present quadrant (one or zero)
B9 = Total number of Starbases in the galaxy
S = Number of stars in present quadrant
S9 = Initial energy of each Klingon
C = Course entered by player
W = Warp entered by player
H = Hit on Enterprise or Klingon in units of energy
I, J = Matrix variables in FOR-NEXT statements
N, X, Y, X1, Y1, X2, Y2 = Multiple-use variables
S1, S2 = Enterprise sector coordinates (down, right)
Q1, Q2 = Enterprise quadrant coordinates (down, right)
Q$ = Characters used in printing a Short Range Scan (.EKB *)
C$ = Condition: Green, Yellow, Red, or Docked
E$ = Multiple-use string variable
D(I) = Number of years for repair of each device where the value of I determines the device.
D$(I) = Descriptive character string for each device where the value of I determines the device: See statements 30 through 70.

The value of I for each device is:
- I = 0 Warp Engines
- I = 1 Short Range Sensors
- I = 2 Long Range Sensors
- I = 3 Phasers
- I = 4 Photon Torpedoes
- I = 5 Galactic Records

K1(I) = Sector coordinate (down) for I^{th} Klingon in quadrant
K2(I) = Sector coordinate (right) for I^{th} Klingon in quadrant
K3(I) = Units of energy left in I^{th} Klingon in quadrant



BLOCK DIAGRAM OF STARTREK

(In the condensed version, the warp engines and torpedo routines are combined to save space)

S(I, J) = Sector Matrix. The values of both I and J are permitted to range from 0 to 7. Together, a given set of values for I and J selects one of the 64 stored numbers that the dimensioned variable S(I, J) has. S(I, J) is used to store the contents of the 64 sectors of the quadrant that the Enterprise is presently in. When the sector is printed out using the Short Range Scan, the value of I associated with each sector determines how far down from the top that sector is printed, while the value of J determines how far to the right it is printed. The contents of each element in the matrix S(I, J) determines what is printed in the associated sector:

1 = Empty space (.)
2 = Enterprise (E)
3 = Klingon (K)
4 = Starbase (B)
5 = Star (*)

Q(I, J) = Quadrant Matrix. Like the sector matrix, this matrix is also defined to have 64 elements; each one stores a number which indicates how many Klingons, Starbases, and stars are in the associated quadrant. No attempt is made to store actual positions of Klingons, Starbases, or stars in any quadrant but the one that the Enterprise is currently in. For the remaining quadrants, only the number of Klingons, Starbases, and stars are stored (in the quadrant matrix). When the Enterprise moves to a new quadrant, the number of Klingons, Starbases, and stars for that quadrant are looked up in the quadrant matrix, and then that many Klingons, Starbases, and stars are randomly positioned along with the Enterprise in the sector matrix when the new quadrant is set up (statements 230 to 300). The numbers stored in the quadrant matrix are what are printed out when Long Range Scans and Galactic maps are printed. When the galaxy is first set up, each element in the quadrant matrix has a negative value. As the Enterprise roams the galaxy scanning quadrants, the values for those quadrants are made positive. The Galactic Map routine (statements 1300 to 1350) only prints positive valued quadrants; i.e. only those previously scanned by the Enterprise. Typical values stored for a quadrant are:

-305 means unexplored, 3 Klingons, no Starbases, and 5 stars
16 means mapped by sensors, no Klingons, 1 Starbase, and 6 stars

Cover Story

Picture yourself as the commander of the Starship Enterprise, preparing to engage a Klingon warship in mortal combat somewhere in the black reaches of space between Alpha Centauri and the edge of the universe.

You are sitting in front of your video display console, calling out data fed into the computer by your able colleague, Mr. Spock, on the status of energy resources available for your phaser banks (as well as those of your enemy) and now you've got to put it all together in time to penetrate the Klingon's force shields before he blisters your hull and sends you hurtling back to the reality of your living room.

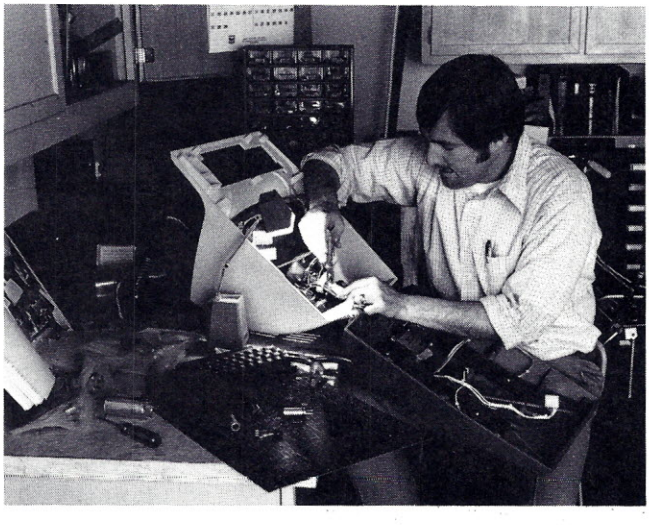
Sounds fanciful? Not when you realize that do-it-yourself computer technology has advanced to the state where it's not only possible to trade the vicarious pleasures of commercial television for the very real thrills of getting into the act yourself, but to also build a setting that comes close enough to the Star Trek scenario to make it fun.

The problem in the not-too-distant past was that while you could build your own computer and program it with store-bought Star Trek Game software, you still had to work around the absence of a build-your-own video display. That is, the kind of display with an integrated keyboard that enabled you to both enter data and display input and output data, to give you the real feeling of command (after all, it's no fun talking to a teletype and pretending its a Starship console).

We all knew, however, that it was only a matter of time before some wily CRT manufacturer realized that there was more than transient fadism to the hobbyist market and jumped in with both feet. It finally happened last month, when Lear Siegler's Electronic Instrumentation Division (Anaheim, CA) offered its highly successful ADM-3 "Dumb Terminal" to the hobbyist in kit form.

Priced at $875 (as opposed to about $1,200 for a factory-assembled model), the Dumb Terminal kit gives the builder a full 24-line, 12-inch screen with 80 characters per line—enough to allow you to trade several shots with your Klingon adversary.

For those now using teletypewriters, the ADM-3 is software compatible; it contains both a 20 mA current loop interface and the EIA standard RS232C interface for direct connection to any standard computer port.



FIRST CRT KIT—Hobbyist Kip Klappenback tackles the chore of assembling his own video display terminal, the Lear Siegler ADM-3 "Dumb Terminal"

```
NULL 0
CLEAR 50
NEW


10 REM  ** STARTREK **   (3/14/76)
10 REM  A GAME OF INTRAGALACTIC WARFARE BASED ON NBC'S POPULAR TV SHOW
10 REM   ADAPTED FOR ALTAIR 8K BASIC (VERSION 3.1) BY L E COCHRAN
10 REM   AND REWRITTEN TO FIT (WITH 8K BASIC) WITHIN 12K OF MEMORY
10 REM    (EXPECT A 4 SEC PAUSE TO SET UP EACH QUADRANT, AND
10 REM      10 SEC AFTER "WORKING")


10 DIM D(5),K1(7),K2(7),K3(7),S(7,7),Q(7,7),D$(5)
20 Q$=". EKB*"
30 D$(0)="WARP ENGINES"
40 D$(1)="SHORT RANGE SENSORS"
50 D$(2)="LONG RANGE SENSORS"
60 D$(3)="PHASERS"
70 D$(4)="PHOTON TORPEDOES":D$(5)="GALACTIC RECORDS"
80 INPUT"PLEASE ENTER A RANDOM NUMBER";E$:I=ASC(E$)
90 I=I-11*INT(I/11):FOR J=0 TO I:K=RND(1):NEXT:PRINT"WORKING-"
100 DEF FND(N)=SQR((K1(I)-S1)^2+(K2(I)-S2)^2)
110 GOSUB 610:GOSUB 450:Q1=X:Q2=Y:X=8:Y=1:X1=.2075:Y1=6.28:X2=3.28
120 Y2=1.8:A=.96:C=100:W=10:K9=0:B9=0:S9=400:T9=3451:GOTO 140
130 K=K+(N<X2)+(N<Y2)+(N<.28)+(N<.08)+(N<.03)+(N<.01):K9=K9-K:GOTO 160
140 T0=3421:T=T0:E0=4000:E=E0:P0=10:P=P0:FOR I=0 TO 7
150 FOR J=0 TO 7:K=0:N=RND(Y):IF N<X1 THEN N=N*64:K=(N<Y1)-Y:GOTO 130
160 B=(RND(Y)>A):B9=B9-B:Q(I,J)=K*C+B*W-INT(RND(Y)*X+Y):NEXT J,I
170 IF K9>(T9-T0) THEN T9=T0+K9
180 IF B9>0 THEN 200
190 GOSUB 450:Q(X,Y)=Q(X,Y)-10:B9=1
200 PRINT LEFT$("STARTREK ADAPTED BY L.E.COCHRAN 2/29/76",8):K0=K9
210 PRINT"OBJECTIVE:  DESTROY";K9;"KLINGON BATTLE CRUISERS IN";T9-T0;
220 PRINT"YEARS.":PRINT" THE NUMBER OF STARBASES IS";B9
230 A=0:IF Q1<0 OR Q1>7 OR Q2<0 OR Q2>7 THEN N=0:S=0:K=0:GOTO 250
240 N=ABS(Q(Q1,Q2)):Q(Q1,Q2)=N:S=N-INT(N/10)*10:K=INT(N/100)
250 B=INT(N/10-K*10):GOSUB 450:S1=X:S2=Y
260 FOR I=0 TO 7:FOR J=0 TO 7:S(I,J)=1:NEXT J,I:S(S1,S2)=2
270 FOR I=0 TO 7:K3(I)=0:X=8:IF I<K THEN GOSUB 460:S(X,Y)=3:K3(I)=S9
280 K1(I)=X:K2(I)=Y:NEXT:I=S
290 IF B>0 THEN GOSUB 460:S(X,Y)=4
300 IF I>0 THEN GOSUB 460:S(X,Y)=5:I=I-1:GOTO 300
310 GOSUB 550:IF A=0 THEN GOSUB 480
320 IF E<=0 THEN 1370
330 I=1:IF D(I)>0 THEN 620
340 FOR I=0 TO 7:FOR J=0 TO 7:PRINT MID$(Q$,S(I,J),1);" ";:NEXT J
350 PRINT"  ";:ON I GOTO 380,390,400,410,420,430,440
360 PRINT"YEARS =";T9-T
370 NEXT:GOTO 650
380 PRINT"STARDATE=";T:GOTO 370
390 PRINT"CONDITION:  ";C$:GOTO 370
400 PRINT"QUADRANT=";Q1+1;"-";Q2+1:GOTO 370
410 PRINT"SECTOR =";S1+1;"-";S2+1:GOTO 370
420 PRINT"ENERGY=";E:GOTO 370
430 PRINT D$(4);"=";P:GOTO 370
440 PRINT"KLINGONS LEFT=";K9:GOTO 370
450 X=INT(RND(1)*8):Y=INT(RND(1)*8):RETURN
460 GOSUB 450:IF S(X,Y)>1 THEN 460
470 RETURN
```

```
480 IF K<1 THEN RETURN
490 IF C$="DOCKED" THEN PRINT"STARBASE PROTECTS ENTERPRISE":RETURN
500 FOR I=0 TO 7:IF K3(I)<=0 THEN NEXT:RETURN
510 H=K3(I)*.4*RND(1):K3(I)=K3(I)-H:H=H/(FND(0)^.4):E=E-H
520 E$="ENTERPRISE FROM":N=E:GOSUB 530:NEXT:RETURN
530 PRINT H;"UNIT HIT ON ";E$;" SECTOR";K1(I)+1;"-";K2(I)+1;
540 PRINT" (";N;"LEFT)":RETURN
550 FOR I=S1-1 TO S1+1:FOR J=S2-1 TO S2+1
560 IF I<0 OR I>7 OR J<0 OR J>7 THEN 580
570 IF S(I,J)=4 THEN C$="DOCKED":E=E0:P=P0:GOSUB 610:RETURN
580 NEXT J,I:IF K>0 THEN C$="RED":RETURN
590 IF E<E0*.1 THEN C$="YELLOW":RETURN
600 C$="GREEN":RETURN
610 FOR N=0 TO 5:D(N)=0:NEXT:RETURN
620 PRINT D$(I);" DAMAGED.";
630 PRINT" ";D(I);"YEARS ESTIMATED FOR REPAIR.":PRINT
640 IF A=1 THEN RETURN
650 INPUT"COMMAND";A
660 IF A<1 OR A>6 THEN 680
670 ON A GOTO 710,310,1250,1140,690,1300
680 FOR I=0 TO 5:PRINT I+1;"= ";D$(I):NEXT:GOTO 650
690 IF D(4)>0 THEN PRINT"SPACE CRUD BLOCKING TUBES.";:I=4:GOTO 630
700 N=15:IF P<1 THEN PRINT"NO TORPEDOES LEFT":GOTO 650
710 IF A=5 THEN PRINT"TORPEDO ";
720 INPUT"COURSE (1-8.9)";C:IF C<1 THEN 650
730 IF C>=9 THEN 710
740 IF A=5 THEN P=P-1:PRINT"TRACK:";:GOTO 900
750 INPUT"WARP (0-12)";W:IF W<=0 OR W>12 THEN 710
760 IF W<=.2 OR D(0)<=0 THEN 780
770 I=0:PRINT D$(I);" DAMAGED, MAX IS .2 ";:GOSUB 630:GOTO 750
780 GOSUB 480:IF E<=0 THEN 1370
790 IF RND(1)>.25 THEN 870
800 X=INT(RND(1)*6):IF RND(1)>.5 THEN 830
810 D(X)=D(X)+INT(6-RND(1)*5):PRINT"**SPACE STORM, ";
820 PRINT D$(X);" DAMAGED**":I=X:GOSUB 630:D(X)=D(X)+1:GOTO 870
830 FOR I=X TO 5:IF D(I)>0 THEN 860
840 NEXT
850 FOR I=0 TO X:IF D(I)<=0 THEN NEXT:GOTO 870
860 D(I)=.5:PRINT"**SPOCK USED A NEW REPAIR TECHNIQUE**"
870 FOR I=0 TO 5:IF D(I)=0 THEN 890
880 D(I)=D(I)-1:IF D(I)<=0 THEN D(I)=0:PRINT D$(I);" ARE FIXED!"
890 NEXT:N=INT(W*8):E=E-N-N+.5:T=T+1:S(S1,S2)=1
900 Y1=S1+.5:X1=S2+.5:IF T>T9 THEN 1370
910 Y=(C-1)*.785398:X=COS(Y):Y=-SIN(Y)
920 FOR I=1 TO N:Y1=Y1+Y:X1=X1+X:Y2=INT(Y1):X2=INT(X1)
930 IF X2<0 OR X2>7 OR Y2<0 OR Y2>7 THEN 1110
940 IF A=5 THEN PRINT Y2+1;"-";X2+1,
950 IF S(Y2,X2)=1 THEN NEXT:GOTO 1060
960 PRINT:IF A=1 THEN PRINT"BLOCKED BY ";
970 ON S(Y2,X2)-3 GOTO 1040,1020
980 PRINT"KLINGON";:IF A=1 THEN 1050
990 FOR I=0 TO 7:IF Y2<>K1(I) THEN 1010
1000 IF X2=K2(I) THEN K3(I)=0
1010 NEXT:K=K-1:K9=K9-1:GOTO 1070
1020 PRINT"STAR";:IF A=5 THEN S=S-1:GOTO 1070
1030 GOTO 1050:2L29E76C
1040 PRINT"STARBASE";:IF A=5 THEN B=2:GOTO 1070
1050 PRINT" AT SECTOR";Y2+1;"-";X2+1:Y2=INT(Y1-Y):X2=INT(X1-X)
1060 S1=Y2:S2=X2:S(S1,S2)=2:A=2:GOTO 310
1070 PRINT" DESTROYED!";:IF B=2 THEN B=0:PRINT". . .GOOD WORK!";
```

```
1080 PRINT:S(Y2,X2)=1:Q(Q1,Q2)=K*100+B*10+S:IF K9<1 THEN 1400
1090 GOSUB 480:IF E<=0 THEN 1370
1100 GOSUB 550:GOTO 650
1110 IF A=5 THEN PRINT"MISSED!":GOTO 1090
1120 Q1=INT(Q1+W*Y+(S1+.5)/8):Q2=INT(Q2+W*X+(S2+.5)/8)
1130 Q1=Q1-(Q1<0)+(Q1>7):Q2=Q2-(Q2<0)+(Q2>7):GOTO 230
1140 I=3:IF D(I)>0 THEN 620
1150 INPUT"PHASERS READY:  ENERGY UNITS TO FIRE";X:IF X<=0 THEN 650
1160 IF X>E THEN PRINT"ONLY GOT";E:GOTO 1150
1170 E=E-X:Y=K:FOR I=0 TO 7:IF K3(I)<=0 THEN 1230
1180 H=X/(Y*(FND(0)^.4)):K3(I)=K3(I)-H
1190 E$="KLINGON AT":N=K3(I):GOSUB 530
1200 IF K3(I)>0 THEN 1230
1210 PRINT"**KLINGON DESTROYED**"
1220 K=K-1:K9=K9-1:S(K1(I),K2(I))=1:Q(Q1,Q2)=Q(Q1,Q2)-100
1230 NEXT:IF K9<1 THEN 1400
1240 GOTO 1090
1250 I=2:IF D(I)>0 THEN 620
1260 PRINT D$(I);" FOR QUADRANT";Q1+1;"-";Q2+1
1270 FOR I=Q1-1 TO Q1+1:FOR J=Q2-1 TO Q2+1:PRINT"    ";
1280 IF I<0 OR I>7 OR J<0 OR J>7 THEN PRINT"***";:GOTO 1350
1290 Q(I,J)=ABS(Q(I,J)):GOTO 1340
1300 I=5:IF D(I)>0 THEN 620
1310 PRINT"CUMULATIVE GALACTIC MAP FOR STARDATE";T
1320 FOR I=0 TO 7:FOR J=0 TO 7:PRINT"  ";
1330 IF Q(I,J)<0 THEN PRINT"***";:GOTO 1350
1340 E$=STR$(Q(I,J)):E$="00"+MID$(E$,2):PRINT RIGHT$(E$,3);
1350 NEXT J:PRINT:NEXT I:GOTO 650
1360 PRINT:PRINT"IT IS STARDATE";T:RETURN
1370 GOSUB 1360:PRINT"THANKS TO YOUR BUNGLING, THE FEDERATION WILL BE"
1380 PRINT"CONQUERED BY THE REMAINING";K9;"KLINGON CRUISERS!"
1390 PRINT"YOU ARE DEMOTED TO CABIN BOY!":GOTO 1430
1400 GOSUB 1360:PRINT"THE FEDERATION HAS BEEN SAVED!"
1410 PRINT"YOU ARE PROMOTED TO ADMIRAL":PRINT K0;"KLINGONS IN";
1420 PRINT T-T0;"YEARS.  RATING=";INT(K0/(T-T0)*1000)
1430 INPUT"TRY AGAIN";E$:IF LEFT$(E$,1)="Y" THEN 110
```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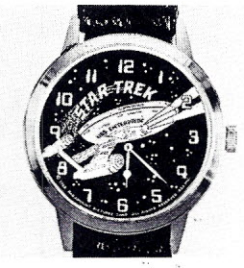

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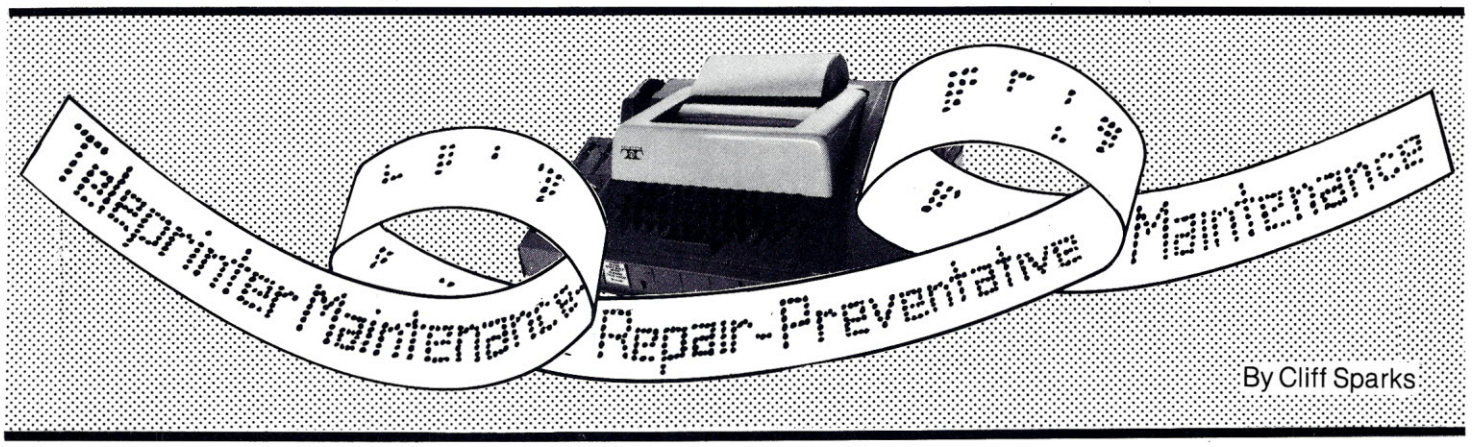


By Cliff Sparks

This is the seventh* article in a series designed to prepare the reader to perform maintenance on the model 33ASR.

The 33ASR tape reader is an 8 level electro-mechanical device which senses and transmits coded intelligence preformatted in tape. Two types of tape readers are available: automatic and manual Figure 1 illustrated to us that the tape reader package consists of three mechanisms: the reader mechanism, the power pack, and the distributor trip mechanism.

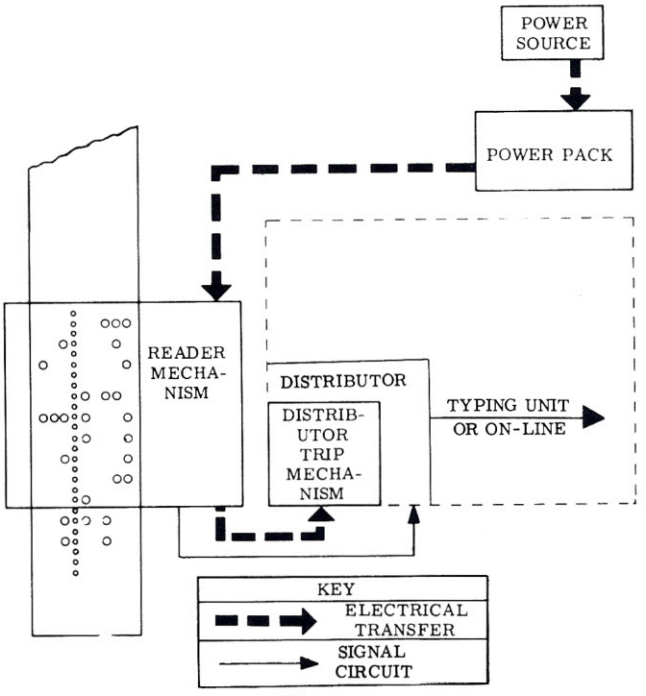


Figure 1
TAPE READER PACKAGE WITH MAJOR MECHANISMS

The reader mechanism senses and feeds the tape. Other submechanisms within the reader mechanism transmit the intelligence as a parallel output. The reader mechanism mounts on the left side of the typing unit. The power pack provides direct current (DC) for the reader mechanism. The power pack is normally a part of the call control unit, but may be mounted in the printer stand.

At this point lets look at the overall make up of the reader. Eight mechanisms consisting of:

1. Tape Lid Mechanism.
2. Control Mechanism.
3. Distributor Trip Mechanism.
4. Feed Magnet Mechanism.
5. Sensing Pin Guide Mechanism.
6. Contact Block Mechanism.
7. Tape Feed Mechanism.
8. Upstop Mechanism.

Figure 2 shows us that when the tape lid latch handle is moved to the right, the spring biased tape lid swings open. Two locating pins guide the tape as it travels above the top of the plate.

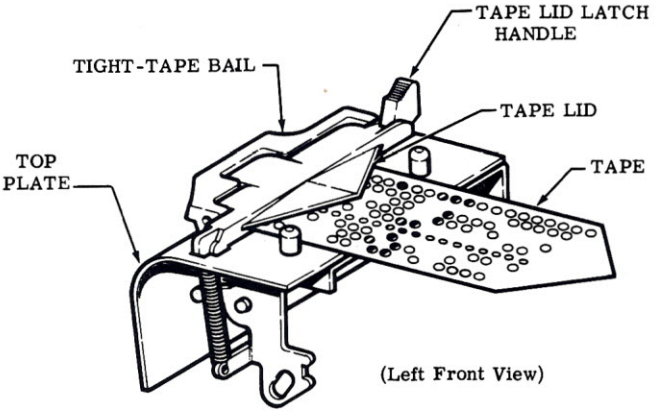


Figure 2
TAPE LID MECHANISM

Figure 3 illustrates to us that the control mechanisms provide the reader with:

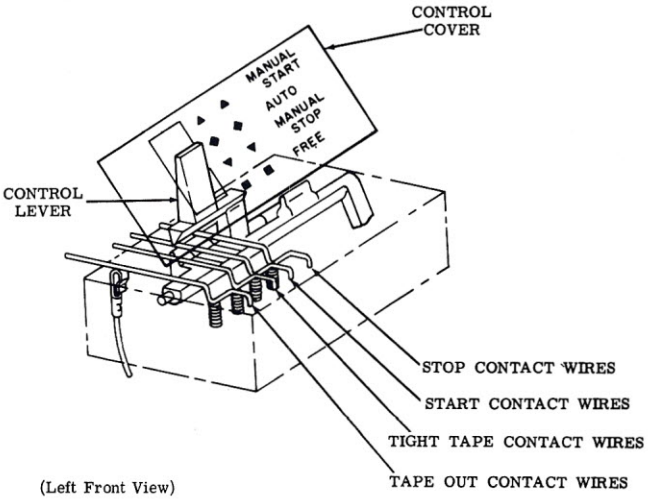


Figure 3
CONTROL MECHANISM

1. START, STOP, and FREE for the manual reader.
2. MANUAL START, AUTO, MANUAL STOP, and FREE for the automatic reader.

When the control lever is moved to the START position (MANUAL START position for the automatic reader) the spring biased start contact wires are positioned on the start contact. Since the start contact wires and the start contact are wired in series with the distributor clutch trip coil in the typing unit, the coil energizes and releases the tape reader trip lever (see Figure 4).

When the tape reader trip lever is released, two functions occur; it closes the tape reader feed magnet contact assembly and trips the distributor clutch (see Figure 4). The reader feed magnet contact assembly is closed by an insulator on the back of the tape reader trip lever. In its travel, the tape reader trip lever rotates the distributor clutch stop bail by means of a projection. This motion is transferred to the distributor clutch trip lever which moves away from the shoe lever. The distributor clutch engages and the distributor cycle begins.

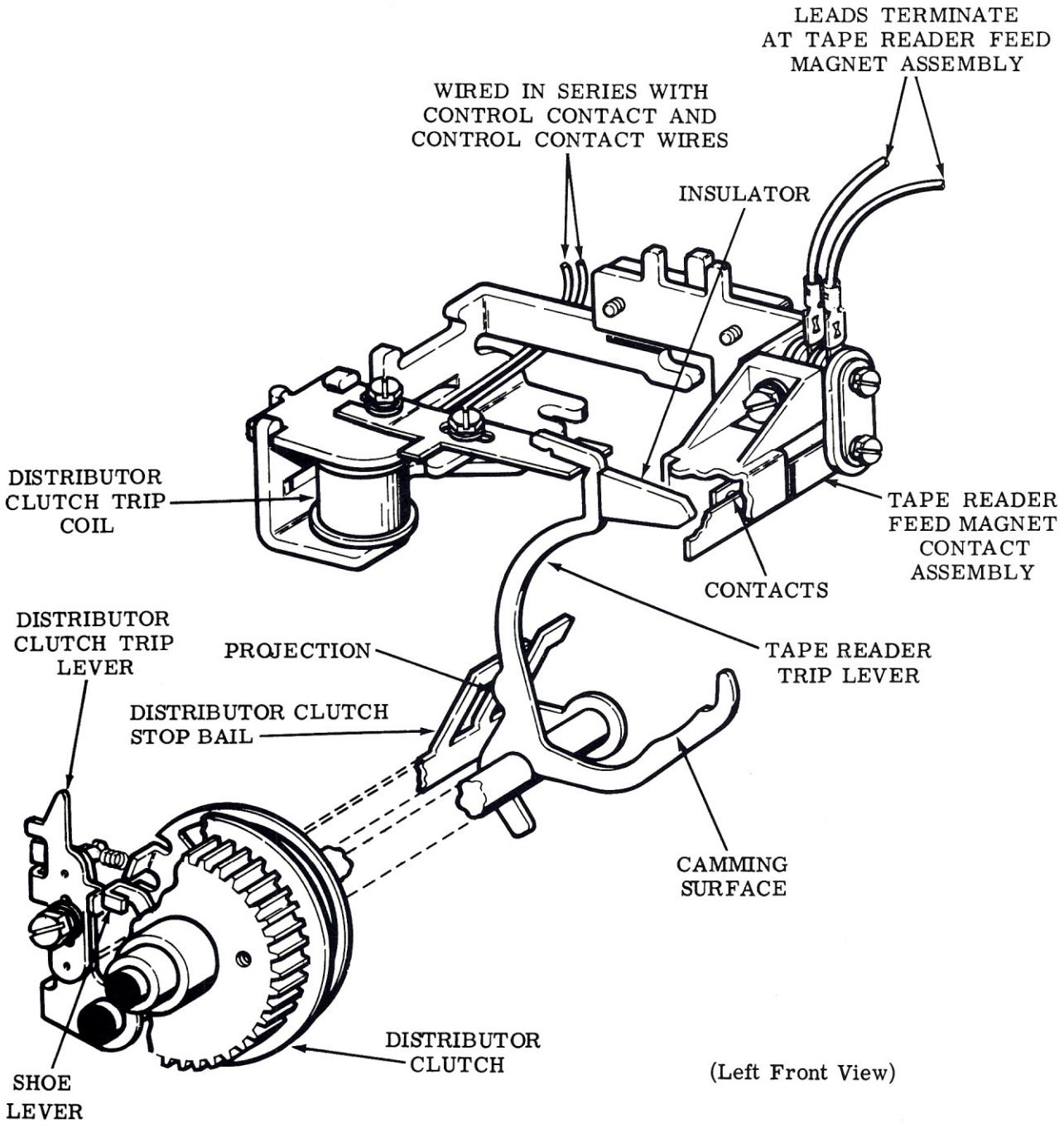


Figure 4
DISTRIBUTOR TRIP MECHANISM

When the feed magnet contacts are closed, the feed magnet in the reader mechanism is activated. The energized feed magnet coil attracts the armature (see Figure 5). Rotating about its pivot the armature raises the armature extensions. Fastened to the ends of the armature extensions is a sensing pin guide.

The sensing pin guides upward travel and carries with it eight spring biased pins which sense the tape. Where a hole exists in the tape (marking) the sensing pin continues its upward travel and its associated spring remains unstretched. Where no hole exists in the tape (spacing) the sensing pin travel is blocked and its associated spring becomes stretched (see Figure 5). At this point it is easy to see that the assembly works something like a hinge on a box, when power is applied the box slams shut, power is removed and the box lid hangs open. The sensing pins seem to go along for the ride, reacting only when a hole in the tape provides a chance for them to pop upward. There is an insulator attached to each sensing pin. The insulators hold eight contact springs in a down position, away from the contact bar (Figure 6). The eight contact springs are connected in parallel to corresponding segments on the distributor disc in the typing unit. If a sensing pin finds a hole in the tape (marking) it continues its upward travel. The insulator attached to it also rises, allowing the contact spring to make contact with the contact bar. Many a sick machine can be restored to service through the careful cleaning and adjustment of the contact bar and contact springs. If the printer garbles data from the tape reader, yet receives good copy from the line and the keyboard, you can be assured that in most cases the contact bar and contact springs are dirty. To double check, simply remove molex plugs 5 and 6 and watch your troubles go down the drain.

Molex plugs 5 and 6 are located on the rear of

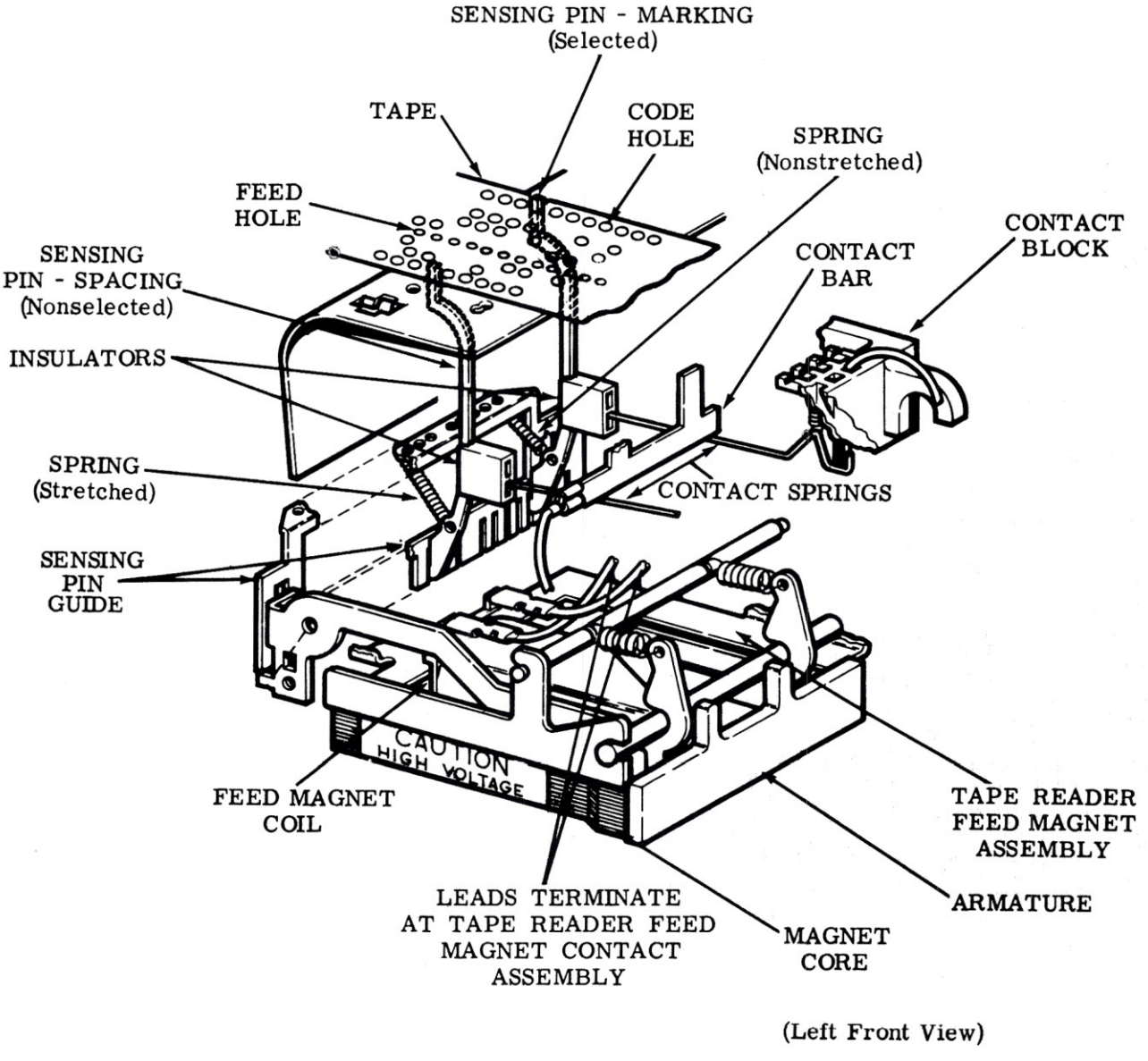


Figure 5
FEED MAGNET AND SENSING MECHANISM

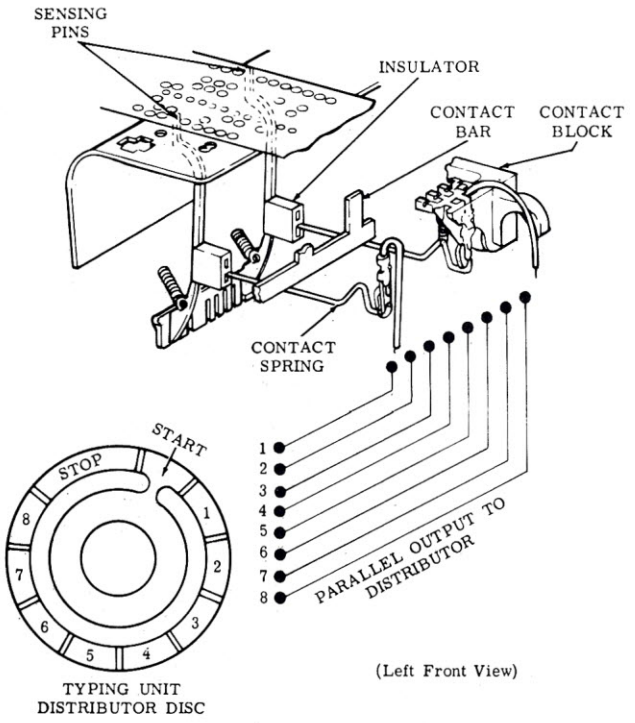
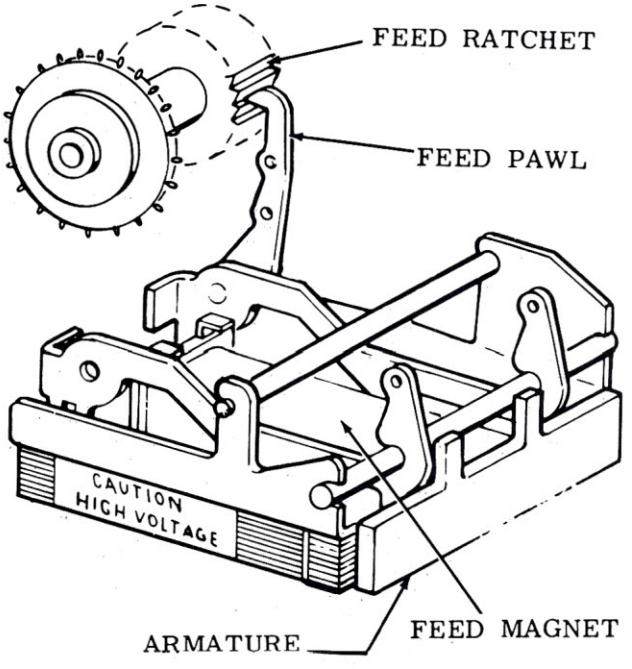


Figure 6
CONTACT BLOCK MECHANISM

your call control unit.

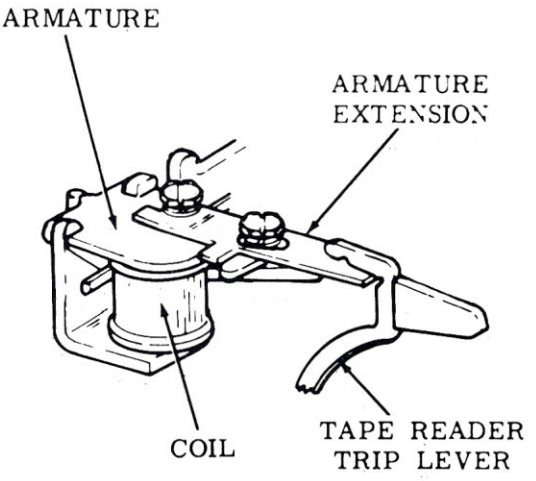
The making and breaking of the feed magnet contacts pulse the feed magnet in the reader. The tape feeding cycle starts with this pulsing action. Figure 7 illustrates that the right armature extension has a feed pawl attached to it. When engaged a tooth on the feed ratchet causes the armature extension to raise. Before the feed pawl can be pulled down to advance the feed wheel one character, a series of steps take place as follows.



(Left Front View)

Figure 7
FEED PAWL ENGAGEMENT

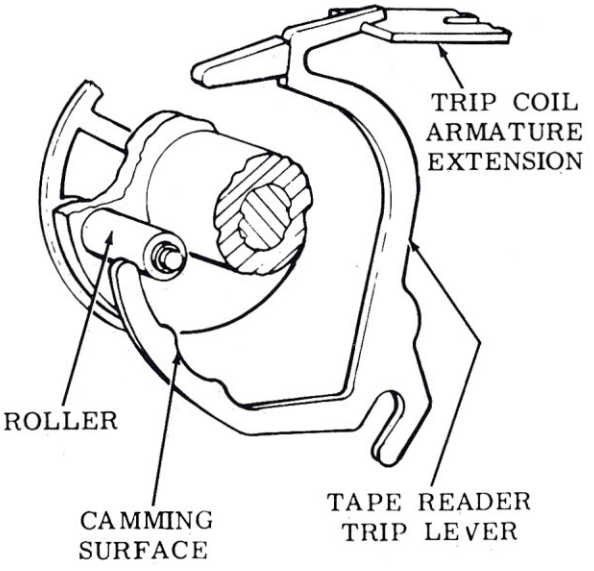
1. The control lever must be held in the START position; this will energize the distributor clutch trip coil. (See Figure 8.)



(Left Front View)

Figure 8
DISTRIBUTOR CLUTCH TRIP COIL

2. Figure 9 shows us that the camming surface on the reader trip lever rides the camming roller on the distributor shaft and overtravels the trip coil armature. This occurs at the beginning of the stop pulse.



(Right Side View)

Figure 9
TAPE READER TRIP LEVER

3. Next the feed magnet contacts open momentarily causing the feed magnet in the reader mechanism to be de-energized (see Figure 10).

4. With the feed magnet de-energized the armature extensions drop, withdrawing the sensing pin guide and the sensing pins (see Figure 11).

5. The tape reader trip lever is not latched due to the energized trip coil, and therefore, the distributor clutch does not disengage. The tape reader trip lever, once again, closes the feed magnet contacts by means of the insulator. The projection moves the distributor clutch stop bail which in turn keeps the

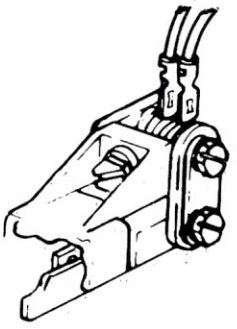


Figure 10
FEED MAGNET CONTACTS

distributor clutch trip lever away from the shoe lever, allowing the clutch to continue its rotation. We now discover that two elements can cause the distributor clutch trip lever to be moved; one, the tape reader feed magnet contacts, and two, the keyboard trip lever. Just for fun let's assume that someone welded the distributor trip lever in the closed position. Our 33ASR would now be a 33KSR. The keyboard would not operate and the tape reader would not function.

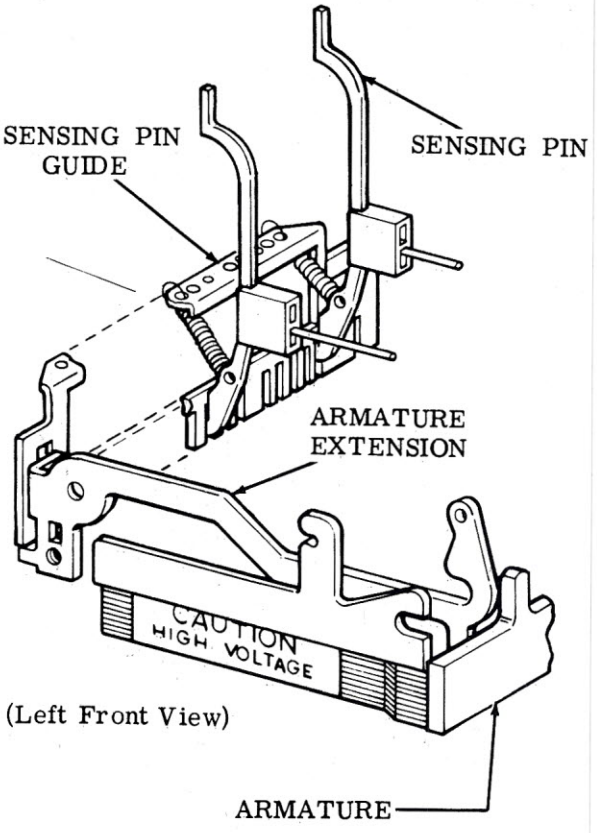


Figure 11
SENSING PIN GUIDE

Therefore if a printer was found to be running wild, or not responding to tape reader commands, I would study the adjustment of the distributor trip lever, the trip coil armature and the keyboard trip lever.

6. Tape feeding will occur at the same time that the sensing pins are withdrawn. As the armature extensions drop down, the pawl advances the feed ratchet one tooth (Figure 12). Associated with the feed ratchet are also a detent lever and a blocking pawl.

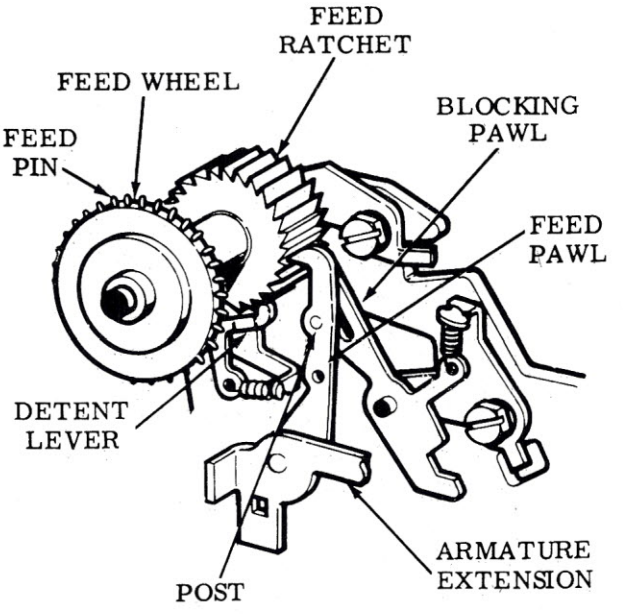


FIGURE 12
TAPE FEED MECHANISM

7. The detent lever, with its circular surface engaging the feed ratchet teeth, holds the feed ratchet and the feed wheel in its correct position during sensing (Figure 12). Any maladjustment in this area will cause the tape to fail during its feeding cycle. If ever two areas of the 33ASR must be in agreement with each other it is the tape gauge of the tape punch and the feeding mechanism of the tape reader. If the feed holes on the tape are not close to ten characters per inch then the feed pins on the feed wheel will rip the feed holes on the tape, causing garbles and much unrest in the otherwise peaceful life of the 33ASR owner.

8. When the blocking pawl rides a post on the feed pawl, it is lowered into engagement with a feed ratchet tooth during the feed stroke. This is to prevent excessive overthrow of the feed wheel during feeding, without the use of a heavy detent spring. It also prevents the pulling ahead of the tape, during sensing, by a tape winder, without the use of a heavy detent spring. During the upstroke of the armature extensions, the blocking pawl is rotated out of engagement with the tooth by the post on the feed pawl (Figure 12).

9. The upstop mechanism is a spring that provides a method of storing energy during the end of the cycle. This energy allows the armature to return to its relaxed position in a smart manner when the cycle is completed.

The *Tight Tape Mechanism* consists of a plastic tight tape bail which snaps into the tape lid. The tight tape bail serves to turn the tape reader OFF when the moving tape becomes taut. The tight tape bail has an extension on it which projects through the top plate. This extension rides on a spring biased tight tape lever. If the tape in the tape reader becomes taut, the bail will be lifted. The bail extension will rotate, causing the tight tape lever to rotate also. In its pivoting motion the tight tape lever

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will lift the tight tape contact wires away from the contact terminal, breaking the current path. With the circuit broken the reader stops. (See Figure 13).

Tape-Out Mechanism. When the paper tape runs out, a tape-out pin protrudes above the surface of the top plate. During tape sensing the tape-out pin is kept depressed by the moving tape. When the tape runs out, the spring biased tape-out pin moves fully up. An insulated extension on the tape-out pin lifts the tape out contact wires away from the contact terminal. This breaks the current patch and the tape reader stops. (See Figure 14). ■

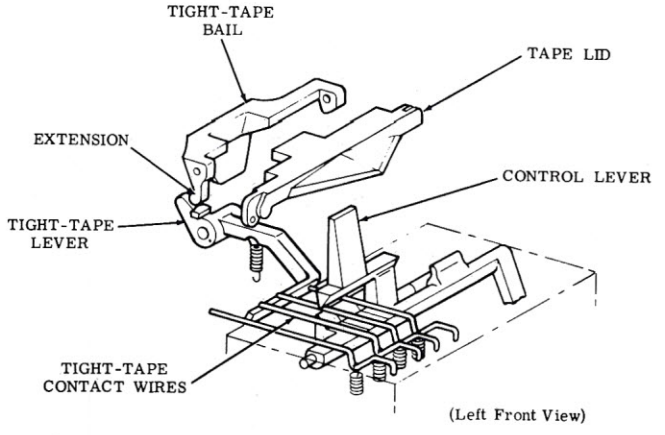

Figure 13
TIGHT-TAPE MECHANISM

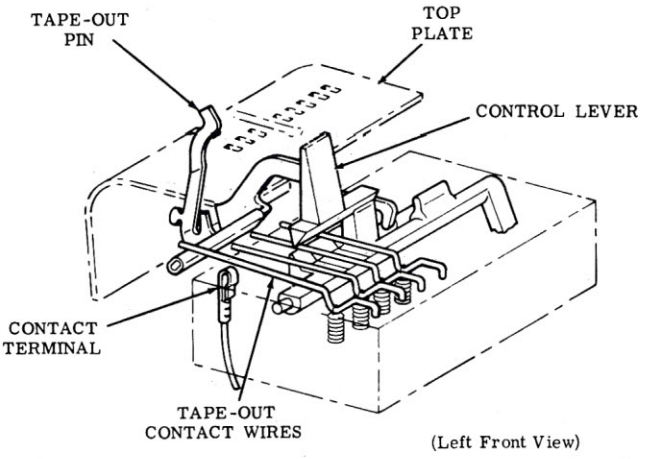

Figure 14
TAPE-OUT MECHANISM

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D. Outputs: Two (2). Board changeable from RS 232 to TTY or TTL digital.
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F. Compatability: Will interface any computer or terminal with a serial I/O. (Altair, Sphere, M6800, PDP8, LSI11, etc.)
G. Other Data: (110-220 V), (50-60 Hz); 3.Watts total; UL listed 955D; three wire line cord; on/off switch; audio, meter and light operation monitors. Remote control of motor optional. Four foot, seven conductor remoting cable provided.
H. Warrantee: 90 days. All units tested at 110 and 2400 baud before shipment. Test cassette with 8080 software program included. This cassette was recorded and played back during quality control.

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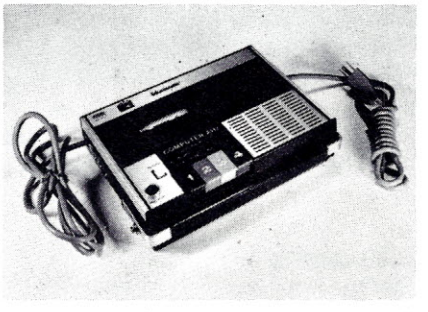

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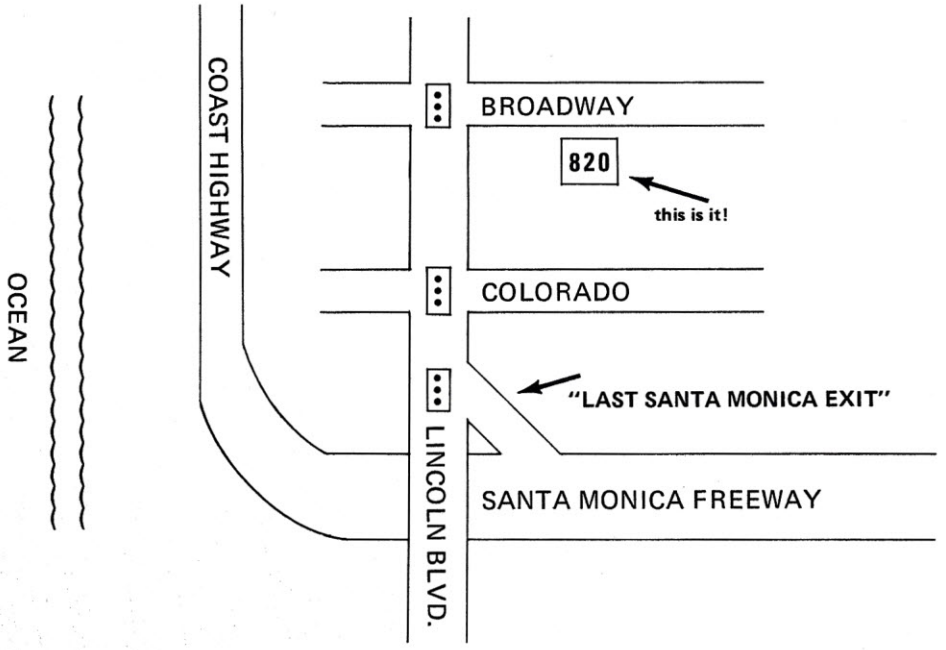

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Microcomputer Applications

Use of Interrupts

by Terry Benson
Field Applications Engineer, Intel Corp.

In the previous microcomputer application articles several timing applications were described. Generating clocks, timing events and serial communication are all within the realm of capability of a microcomputer system. Using the program to generate these timing functions is, many times, the most practical and cost effective approach for use in a microcomputer system. The one drawback, however, is the fact that a major portion of the system operation is dedicated to performing the timing functions. If several external functions are being monitored, timing is difficult to generate due to the variety of program paths that can be executed. If data throughput is of prime concern, the microcomputer may not have the capacity to become involved in timing functions. For these and other reasons it is likely that your system will eventually get "interrupted."

INTERRUPTS

As the term implies, an interrupt is an event that "interrupts" the normal program flow. Let me use an analogy to describe interrupts: When you're mowing the lawn and get interrupted by a telephone call, you leave the lawn mover where it is and go answer the phone—you "process the interrupt." When you are finished with the call, you go back to the lawn mower and continue cutting the grass. The main program flow—cutting the grass—has been interrupted, but the program location has been saved so that the main task can be resumed upon completion of the interrupt. Some overhead functions may also have to be performed, such as turning the engine off and starting it again to resume mowing the lawn.

Interrupts can take on various forms in a microcomputer system. There are software interrupts—basically subroutine operations periodically performed throughout the main program—and hardware interrupts. Hardware interrupts might be from an operator pushing a button (keyboard?), a peripheral device requesting data, or a periodic timing signal (real time interrupt). In fact, it might be an incoming telephone call (just as in our analogy), where remote data monitoring is being performed and a central computer calls to get the accumulated data. In all cases the use of interrupts allows an increase in processing efficiency since the CPU does not have to spend as much time monitoring external functions.

When interrupting a program, certain overhead operations are often required to allow the processor to resume program execution when the interrupt routine has been completed. First of all, the processor must stop at a convenient point, which is normally the end of an instruction. For this reason, the time to respond to an interrupt is dependent on the length of time it takes to execute an instruction. Another operation that must be performed is the saving of the program counter. Various other registers within the CPU may also have to be saved to allow use of these registers by the interrupting software subroutine. Some microprocessors automatically save the contents of all of the CPU registers, whereas other processors, like the Intel 8080, allow the user to optionally save desired register contents.

Saving and Restoring Register Contents

The reasons for saving the contents of the CPU's internal registers may not be immediately obvious but the primary reason is that by doing so the registers become available for use by the interrupt subroutine. (The interrupted program is normally not aware that an interrupt has occurred and may have important information stored in the registers.) Since most data will be transferred through the accumulator, it is normally desirable to save the contents of the accumulator. Further, since the flags are often affected by use of the accumulator, it is desirable to save the internal flags as well. Depending on the subroutines being performed during interrupt, it may also be desirable to save the memory address pointer plus the contents of other registers to make additional registers available. The overhead involved in saving all of this data is only half of the total overhead. The other half is involved when all of the data is restored upon completion of the interrupt subroutine.

In order to illustrate the save and restore instructions for the Intel 8080, let us assume that, during an interrupt, all internal registers of the 8080 are to be used. This requires that the contents of these registers be saved at the beginning of the subroutine and restored at the end. Figure 1 illustrates the program steps required to save and restore the contents of all registers. Notice that the order of restoring data is opposite from the order in which the data is saved. This is required since the memory area that is used as temporary storage is addressed as a LIFO (last-in-first-out) stack.

```
PUSH PSW    ;SAVE THE PROGRAM STATUS WORD—
            ;     ACC AND FLAGS
PUSH H      ;SAVE THE H & L REGISTER CONTENTS
PUSH D      ;SAVE THE D & E REGISTER CONTENTS
PUSH B      ;SAVE THE B & C REGISTER CONTENTS
— — —       ;MAIN BODY OF INTERRUPT ROUTINE
POP B       ;RESTORE B & C CONTENTS
POP D       ;RESTORE D & E CONTENTS
POP H       ;RESTORE H & L CONTENTS
POP PSW     ;RESTORE FLAG & ACC CONTENTS
RET         ;RESTORE PROGRAM COUNTER
```

Figure 1
SAVING AND RESTORING ALL REGISTERS

Polled Interrupts

When a hardware interrupt occurs, the CPU must have enough information to determine where in memory the interrupt subroutine is located. In some CPU's this is always a fixed address. For example, with the Intel 4040, the program counter is always set to location 3 when an interrupt occurs. If only a single interrupt is implemented, this creates no problem. However, if additional interrupts are required, but each one causes the processor to jump to the same location, the interrupt subroutine must distinguish between the various interrupts. This simply requires that the program be used to "poll" all possible interrupts to determine which one activated the interrupt line. In cases where multiple interrupts can occur, not only is polling required but also a priority resolution—taking the most important one first—will need to be implemented.

Let us assume that an 8080 system will respond to eight interrupts but each interrupt causes the program counter to be set to 56. (This is not just an arbitrary address, but is the address which is the result of executing an RST 7. This instruction can be conveniently generated by the Intel System Controller (8228) whenever an interrupt occurs. Thus, it is easy to cause the 8080 to branch to location 56 in our single level interrupt example.) Figure 2 shows the implementation of an eight interrupt system. The subroutine in Figure 3 shows one way in which up to eight interrupts can be polled. The comments in the program describe the functions being performed but a few points should be noted:

1. Registers B and C were not pushed—they are not used in the existing subroutine. However, the individual subroutines may require the use of registers B and C;
2. At line 5, the "-2" is due to the fact that the increments (lines 9 and 10) are performed prior to any tests;
3. At line 7, register B can be used as a mask for any interrupt(s)—see below for more detail;
4. Lines 18 through 25 contain the addresses where the individual subroutines are located;
5. The highest priority is bit 7 since it is tested first (bits are numbered 0 to 7, with bit 0 the least significant bit).

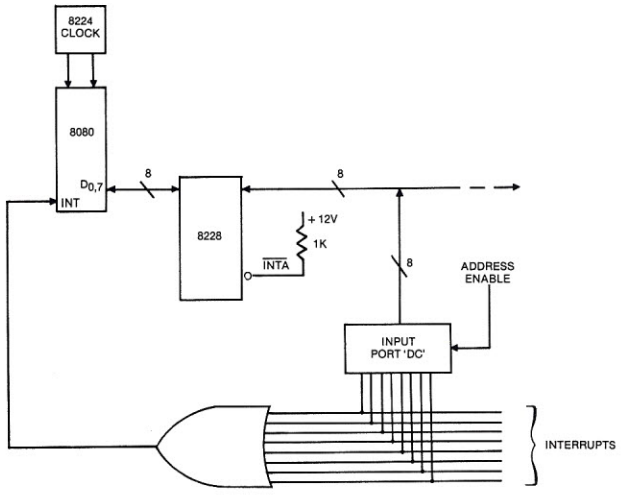


Figure 2
SOFTWARE POLLED
8-INTERRUPT, SINGLE LEVEL SYSTEM

The interrupt mask, which is stored in register B for this example, allows the program to ignore certain interrupts. Initially, the mask will be set to all ones, enabling all interrupts. In systems where not all interrupts are implemented or where certain interrupts are to be ignored, the appropriate bit in the mask register is set to zero. For example, if only five interrupts were to be used in this system, the interrupt mask would be set to F8H at the beginning of the program: MVI B, 0F8H. In this way, the three least significant bits of input port "DC" will be ignored. This method allows a common interrupt polling procedure for various applications and shortens polling time if no interrupts are to be processed. (Although register B can be used for the mask throughout the program, the mask would probably be stored in some memory location and moved to register B when required. In this case register B should be saved and restored when interrupted.)

One difficulty with this software polling technique is that the lower the priority of the interrupt, the longer the polling takes to determine which input caused the interrupt. One method for simplifying this is to add, in hardware, a priority encoder that indicates the highest interrupting device. Figure 4 shows how this can be implemented with the Priority Interrupt Control Unit (Intel 8214). This device not only prioritizes the inputs but also performs the "OR" function to generate the INT signal to the 8080. The program is then modified by removing lines 5 through 12 and inserting:

```
LXI H, INTBL    ;SET BEGINNING OF BRANCH TABLE
IN ODCH         ;GET DATA
ANI OEH         ;00001110
MOV E, A        ;SAVE DATA
MVI D, O        ;SET REGISTER D = 0
DAD H           ;COMPUTER OFFSET
```

Notice that the three encoded bits are placed on input bits 1, 2 and 3 (not 0, 1 and 2) so that each interrupt level modifies the branch table address by 2. (An interrupt mask may also be incorporated with the use of the priority encoder and the technique can use a combination of both hardware and software).

```
Line No.
 1          ORG     56
 2  INTER:          PUSH PSW        ;SAVE ACC AND FLAGS
 3                  PUSH H          ;SAVE H & L
 4                  PUSH D          ;SAVE D & E
 5                  LXI H, INTBL-2  ;SET BEGINNING OF BRANCH TABLE LESS 2
 6                  IN ODCH         ;GET INTERRUPT BITS
 7                  ANA B           ;MASK UNWANTED INTERRUPTS
 8                  JZ INTND        ;CHECK FOR END OF INTERRUPTS
 9  NXTIN:          INX H           ;COUNT TO NEXT BRANCH TABLE ADDRESS
10                  INX H
11                  RAL             ;GET NEXT INTERRUPT BIT
12                  JNC NXTIN       ;IF NOT ON GO TO NEXT INTERRUPT
13                  MOV E, M        ;GET TABLE CONTENTS TO D & E
14                  INX H
15                  MOV D, M
16                  XCHG            ;MOVE CONTENTS TO H & L
17                  PCHL            ;SET PC COUNTER TO CONTENTS IN TABLE
18  INTBL:          DW INT8         ;EACH TABLE ENTRY IS A 2 BYTE ADDRESS
19                  DW INT7         ; WITH THE LEAST SIGNIFICANT BYTE FIRST
20                  DW INT6
21                  DW INT5
22                  DW INT4
23                  DW INT3
24                  DW INT2
25                  DW INT1
26  INTND:          POP D           ;ALL INTERRUPT ROUTINES WILL END HERE
27                  POP H
28                  POP PSW
29                  EI              ;ENABLE FUTURE INTERRUPTS
30                  RET
```

Figure 3

Vectored Interrupts

We have just discussed a way that the 8080 can be used with multiple inputs on a single level interrupt. Many microprocessors allow only the single level type of interrupt operation. Others, like the 8080, can be used in a "vectored" interrupt mode. Basically, this allows the interrupting device to cause the CPU to branch directly to the interrupt subroutine for that device. This method can greatly reduce the overhead processing time since no polling by software is required.

When the 8080 acknowledges an interrupt, it expects an instruction from the data bus just as if it were fetching an instruction from memory. The vector is created by having the interrupting device provide an instruction (RST or CALL) plus an address. Since the restart instructions (RST 0 through RST 7) are only single bytes, it is much easier for hardware to generate the restart than a CALL. Figure 5 illustrates a method for connecting up to eight vectored interrupts to an 8080 system. In this example, the three output bits from the 8214 are used to provide the three variable bis of the RST instruction. The other five bits are forced to a "1" thus generating the RST instruction. (The B0-B2 inputs to the 8214 are used for masking and will not be discussed as a part of this application. For additional information on the use of the 8214, refer to the Intel 8080 User's Manual.)

With this vectored approach, whenever an interrupt occurs and is acknowledged, the RST instruction will cause the program counter to be set to 0, 8, 16, 24, 32, 40, 48 or 56 (corresponding to RST 0 through RST 7, respectively). Due to the spacing of these addresses, only eight bytes are available. This suggests that an unconditional branch (JMP) will be required to execute additional bytes of the subroutine. Using the vectored technique requires that each interrupt procedure include the PUSH instructions at the beginning of the routine. Alternatively, a PUSH subroutine can be called by each interrupt procedure. The POP instructions can be common, however, as in Figure 3.

Resetting Interrupts

System interrupts can come from a variety of sources and will be active for different amounts of time. A timing pulse from a rotating motor may last a few milliseconds; a keyboard depression may last hundreds of milliseconds; and a door opening may last forever (in computer time). For these reasons it will normally be required to latch the interrupt signal into a flip-flop with the leading edge of the interrupt. This adds one more function to the interrupt routine: the flip-flop must be reset when the interrupt is acknowledged. In some cases it will be possible to reset the flip-flop with hardware logic but the microcomputer can be used to eliminate these parts.

For some types of interrupts, the flip-flop buffer will not be necessary. If special restrictions can be placed on the interrupt, it may operate with direct input to the microprocessor. One example would be in a case where a timing pulse is generated for a real-time clock. If the timing pulse were longer than the worst case response time from the processor, it will always be recognized. On the other hand, it must not last longer than the interrupt subroutine takes to process the interrupt. Therefore, we can define a

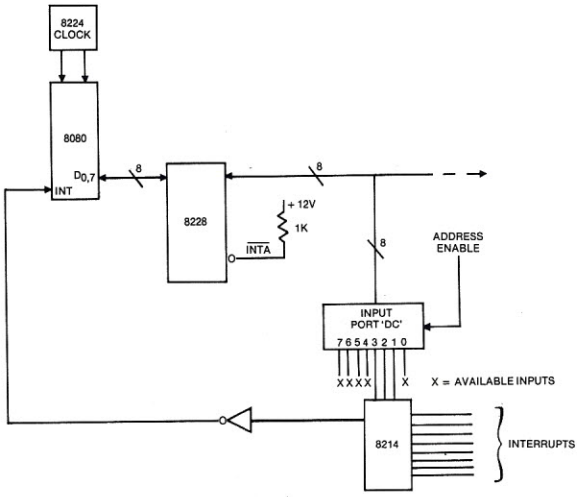


Figure 4
HARDWARE PRIORITY
8-INTERRUPT, SINGLE LEVEL SYSTEM

"time window" that dictates the minimum and maximum pulse width. It should be obvious that, as the number of interrupt inputs increases, this window will be more difficult to predict. For systems of single interrupts probably no buffer will be required. However, for systems of multiple interrupts, whether single level or vectored, resettable flip-flop buffers should be considered.

Interrupt Examples

Real-time interrupts are desirable in systems where events are timed or, especially, where the time of day is necessary for system operation. The interrupt frequency can be determined by the timing resolution required, by the time available to process the interrupts, by the desire for minimum hardware count (the lower the frequency, the more dividers required), or by a combination of all three. Figure 6 shows a subroutine that uses a 100 millisecond interrupt and keeps track of time of day. The interrupt generates a vectored interrupt to memory address 8 using RST 1. Using the same technique other timing rates can be used and other features can be added to the program. In this case, the time values are made available to the entire program through the memory locations as labeled. For programming simplification all time values are stored in consecutive locations in memory. (During initialization in the main program, these four values should be preset or a subroutine may be incorporated to allow the operator to initialize the time values.)

The second example demonstrates the use of interrupts for serial data communications. If you recall from the previous article, a complete routine for serial data communication was developed. One drawback to this routine is the inordinate amount of time the program has to spend checking for an incoming

PRIORITY REQUEST		RST	D_7	D_6	D_5	D_4	D_3	D_2	D_1	D_0
LOWEST	0	7	1	1	1	1	1	1	1	1
	1	6	1	1	1	1	0	1	1	1
	2	5	1	1	1	0	1	1	1	1
	3	4	1	1	1	0	0	1	1	1
	4	3	1	1	0	1	1	1	1	1
	5	2	1	1	0	1	0	1	1	1
	6	1	1	1	0	0	1	1	1	1
HIGHEST	7	*0	1	1	0	0	0	1	1	1

*RST 0 WILL VECTOR PROGRAM COUNTER TO LOCATION 0 (ZERO) AND INVOKE THE SAME ROUTINE AS "RESET" INPUT TO 8080.
THIS COULD RE-INITIALIZE THE SYSTEM BASED ON THE ROUTINE INVOKED.
(A CAUTION TO SYSTEM PROGRAMMERS.)

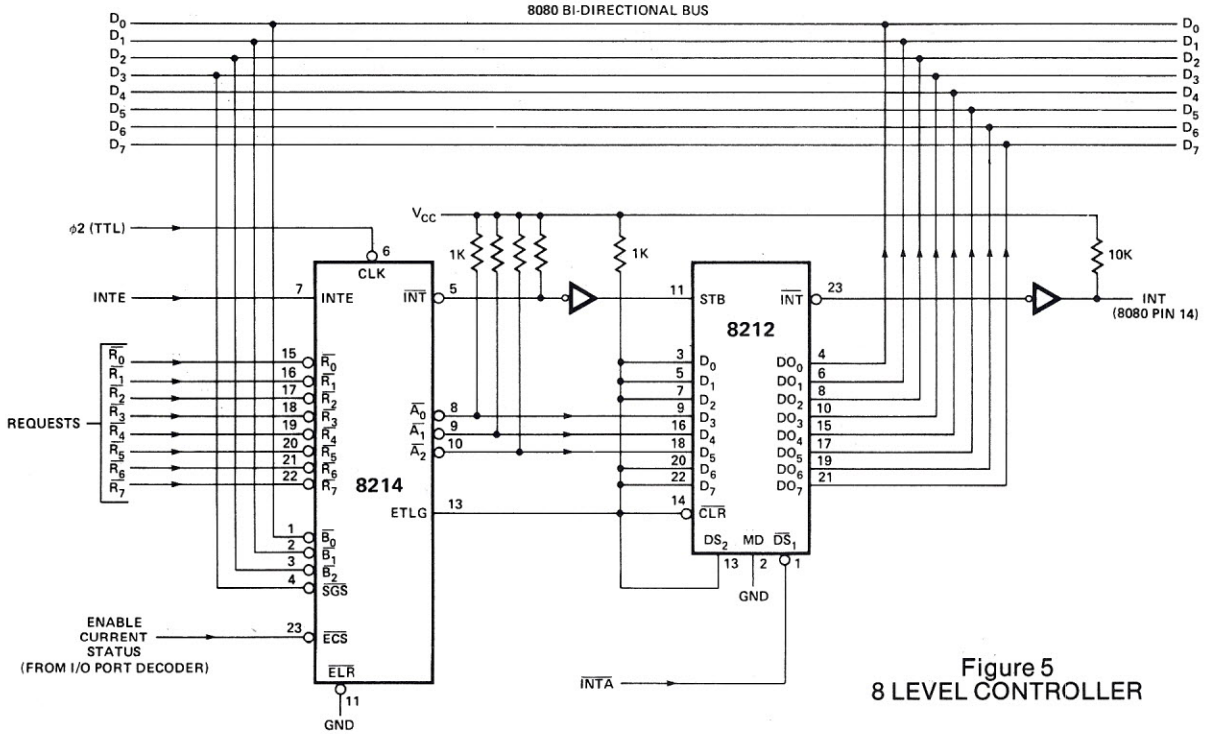
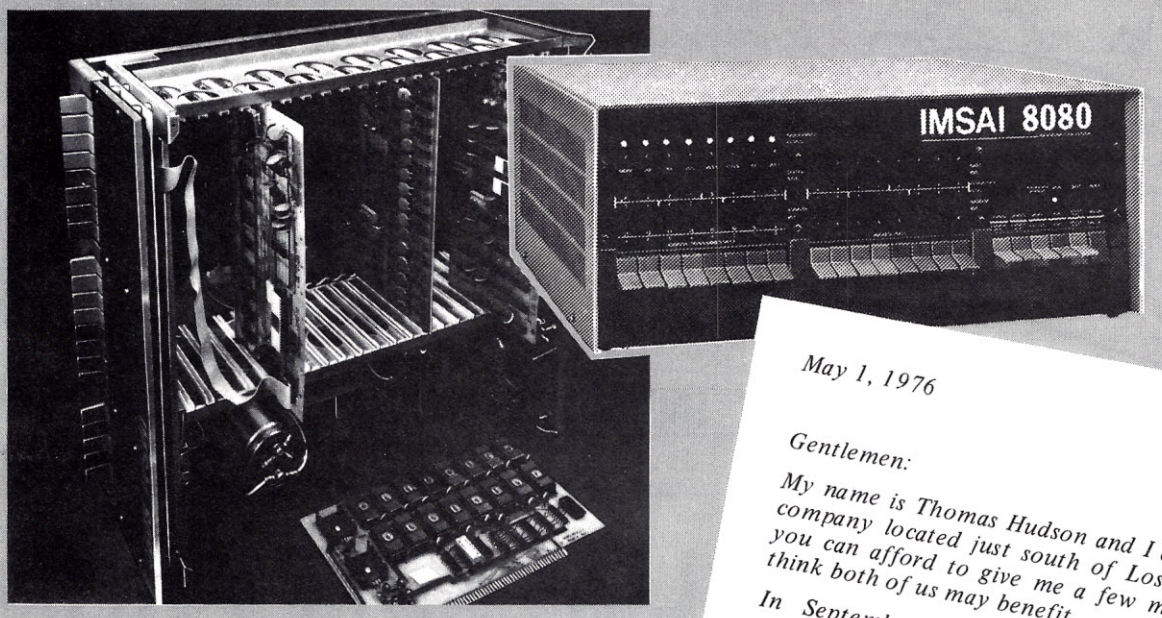


Figure 5
8 LEVEL CONTROLLER

```
                ;THE FØLLØWING IS AN EXAMPLE ØF AN INTERRUPT
                ;RØUTINE FØR THE INTEL 8080.
                ;IT DEMØNSTRATES A REAL-TIME INTERRUPT USING
                ;A 100 MS. CLØCK.
                ;
                ;THIS SECTIØN IS USED TØ RESERVE MEMØRY
                ;SPACE FØR THE TIME VALUES.
                ;
133F                    ØRG 133FH       ;ARBITRARY RAM ADR
133F            TENS:   DS 1            ;1 BYTE FØR TENTH ØF SECØNDS
1340            SEC:    DS 1            ;1 BYTE FØR SECØNDS
1341            MIN:    DS 1            ;1 BYTE FØR MINUTES
1342            HRS:    DS 1            ;1 BYTE FØR HØURS
                ;
                ;.1 SEC INTERRUPT
                ;
0008                    ØRG 08H
0008 F5         INT1:   PUSH PSW        ;SAVE ACC AND FLAGS
0009 E5                 PUSH H          ;SAVE H & L
000A D5                 PUSH D          ;SAVE D & E
000B 1E02               MVI E,2         ;USED FØR SEC/MIN LØØP
000D C30001             JMP CLØCK       ;ALL 8 BYTES ARE USED
                ;
0100                    ØRG 100H        ;BEGIN AFTER RESTART AREA
0100 213F13     CLØCK:  LXI H, TENS     ;FØR TENTHS ØF SEC
0103 35                 DCR M           ;DECREMENT 1/10 SEC CØUNTER
0104 C22101             JNZ CKEND       ;GØ TØ CLØCK END IF NØT YET ZERØ
0107 360A               MVI M,10        ;RESET CØUNTER TØ 10
0109 23                 INX H           ;INCREMENT TØ SEC VALUE
010A 7E         CLK1:   MØV A,M         ;GET SEC ØR MIN
010B 3C                 INR A
010C FE3C               CPI 60          ;CHECK FØR SEC ØR MIN ØVERFLØW
010E C22001             JNZ CLK2
0111 AF                 XRA A           ;CLEAR A
0112 77                 MØV M,A         ;SAVE NEW SEC ØR MIN
0113 23                 INX H           ;CØUNT TØ MIN ØR HRS
0114 1D                 DCR E           ;GØ THRU THIS TWICE
0115 C20A01             JNZ CLK1
0118 7E                 MØV A,M         ;GET HRS
0119 3C                 INR A
011A FE18               CPI 24          ;CHECK FØR NEW DAY
011C C22001             JNZ CLK2
011F AF                 XRA A           ;START AT 00 HRS
0120 77         CLK2:   MØV M,A         ;SAVE VALUE LAST INCREMENTED
0121 D1         CKEND:  PØP D           ;RESTØRE CØNTENTS ØF D & E
0122 E1                 PØP H           ;RESTØRE CØNTENTS ØF H & L
0123 F1                 PØP PSW         ;RESTØRE CØNTENTS ØF ACC & FLAGS
0124 FB                 EI              ;ENABLE INTERRUPTS
0125 C9                 RET
0000                    END
```

Figure 6
ISIS 8080 MACRO ASSEMBLER, VI.0

Branch to . . . pg. 61



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May 1, 1976

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In September of 1975 I decided to attempt to sell microprocessor-based computing systems to the commercial market. I visited every microprocessor-based kit manufacturer in the United States, and questioned numerous people in the industry. For many reasons, all of which hold true today, I decided on the Intel 8080 family of microprocessors as the best hardware choice. In November of 1975 we decided on a product offered by a company in San Leandro, California, IMS ASSOCIATES INC. Before Christmas we had 3 IMSAI 8080 kits on the way, and they have operated flawlessly ever since we turned on the power. We still use these original kits as development tools and for some really neat games. The IMSAI 8080 microprocessor kit is of the highest quality available. Company management is excellent, the engineers are first-class, deliveries are almost on time (within days, not months), and the ability to run DEC derived BASIC and FOCAL is a powerful not to be overlooked advantage. Once over the usual arguments for and against various chips, assuming you decide (wisely) on the 8080, the obvious best choice is IMSAI. I feel from experience that you cannot buy a better microprocessor-based kit.

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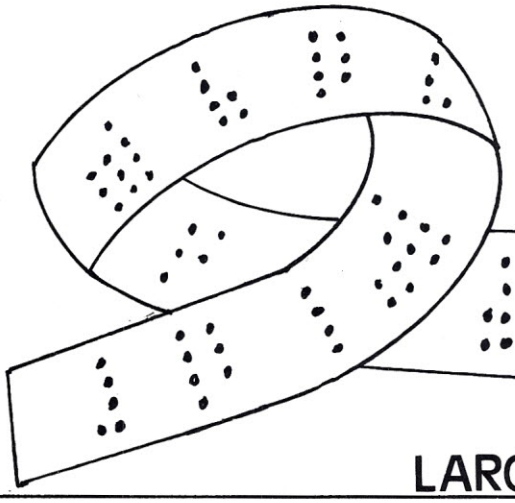

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Volume 1 ***

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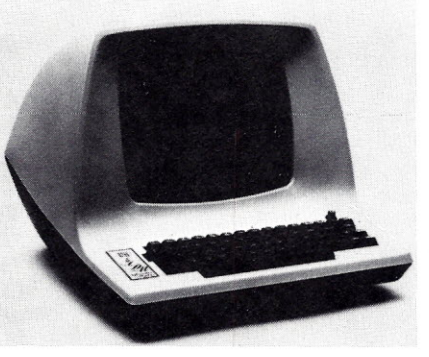
Seeking help, he called the Computer Mart the next morning, and found the solution to maintaining a happy marriage—a set of $875.00 ear plugs. Computer Mart shipped immediately (is there any other way?) the ear plugs (and one ADM-3 Kit used as packing material, of course).

You may now visit a happy John in Northern California, busily soldering his new kit—but, speak up, as he seldom remembers to take out the ear plugs. The whole family is also happy as the ADM-3, when completed, is silent in operation.



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ORANGE, CA.—John French, General Manager of the Computer Mart, states that a surprising number of industrial firms have ordered ADM-3 kits to allow the technicians in-house to become familiar with the terminal construction, design philosophy and overall operation thereby cutting down on the need for outside service support.

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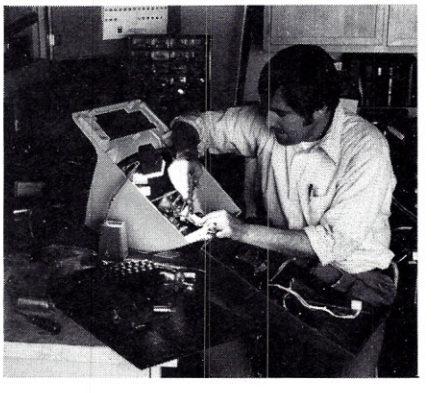

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CALCULATIN' ENGINES

By William E. Peterson

In the April issue we went into some of the historical aspects of early arithmetic and ancient calculating devices. The early arithmetic knowledge is required if we are to understand that very simple techniques were "state of the art" for thousands of years. Hence, the calculatin' engines devised and branches of mathematics developed were attempts to get around the basic problem of various number systems.

Let us not scorn the people of that time for being unable to multiply and divide easily. It was a fundamental problem of using a number system that only allowed answers to be written down. With our positional (and decimal) system, we should be able to solve such problems with ease, yet hand held four function calculators are selling like hot cakes. How would you like to be the fellow who invented the integrated circuit "only to do four arithmetic functions" and get a penny apiece for each one produced? You could retire yesterday!

The mechanical adding and subtracting machine to first use gears was invented by Blaise Pascal (1623-1662). The design he used is still made today. It consists of several circular discs, each disc on its own shaft. Each disc occupies a *position* related to the decimal notation. Hence the first disc on the right is the *units* disc, the next the *tens* disc, the next the *hundreds* disc and so on. Each disc has ten equally spaced and numbered holes around its perimeter. The holes are designated 0 to 9. A pencil or other pointer is inserted in the required number hole and the disc rotated clockwise until a fixed stop is reached. That number is now "stored" in the machine. For example, the *units* disc might be used to "store" 8. To now add, say, 9 to that, the pointer is inserted in the 9 hole and the *units* disc again rotated clockwise to the stop. The *units* disc now would "read out" 7 under a mark on the main frame. The *tens* disc would have moved one position and indicate 1. Hence the answer 17. Gears on the *units* and *tens* shafting were used in coupling the "carry" of 1 to the tens disc. Because gears operate equally well in both directions, by rotating the discs *counter clockwise* subtraction can be accomplished with the same instrument. Incidentally, Pascal built this machine out of brass for his father who was a shopkeeper. Trouble was his father could not add or subtract and so had trouble giving change. So this first geared adding machine was really used not for science, but as a cash register!

The impetus of commerce has done much for computers! You can still buy a cheap ($1) plastic version of Pascal's calculator. Take a look in a five-and-dime or a supermarket GOODY section and you'll find it. Pascal's original model of this adding machine still exists, and he later became a reknown French scientist, philosopher and something of a mystic.

Another inventor of note in the "four function calculator" business was Gottfried Wilhelm Leibnitz, almost a contemporary of Pascal. Leibnitz (1646 to 1716) was a well known mathematician of his day. While Pascal's machine only could add and subtract Leibnitz wanted to build a "multiplier." He finally worked one out that operated by adding. Twenty years of construction time was spent on this multiplier. It, too, still exists, only it's in Hanover.

In reading of the development and construction of these early devices it is interesting to note the tremendous time spent on devising machines and doing calculations. For example, Keppler (1571-1630) the astronomer and originator of "Keppler's Three Laws" of astronomy spent twenty years computing the distance from the earth to the sun. That's why "four function" devices were to achieve such rapid use. A shop keeper who couldn't add could suddenly give change.

Real production of adding machines is generally credited to Charles Xavier Thomas of Alsace, France. His production by 1865 had amounted to 500 machines. Germany, not to be outdone, improved on the adding machine, and in 1878 Arthur Burkhardt founded the new industry in Germany.

All of these devices had problems getting "data" (the numbers) into the machine. An American, Dorr Eugene Felt, was granted a patent in 1887 for a key driven data input adding machine. We're still using the same idea for IBM 360's.

By 1908 an engineer and former teacher at Leland Stanford University founded an office machine company near Turin, Italy. His name: Camillo Olivetti. The company has produced many mechanical adding machines since that date. They're still in the office equipment business.

While all these calculatin' engines were becoming more and more complex, a very standard simple device was in general use, called the *sector*. The sector was the slide rule's predecessor and was put into its most useful form by Galileo (1564-1642). It consists of two rules tied together at one end by a hinge. The wide variety of capabilities is possible by having different scales marked on the two rules. The sector actually operates on the basis of similar triangles, where one of the triangle corners is the hinge.

Galileo and an efficient workman, Marcantonio

Mazzoleni, perfected the sector just prior to 1600. By using a pair of dividers and a sector, lengths were taken from various scales graduated on the two rules and made possible squaring, squareroots, cubes, reciprocals, chords, tangent, densities of metals, etc. Special sectors (just like specialized slide rules) were developed for gunnery, surveying, clock construction. Since the sector resembled a compass (drafting instrument) then these special instruments were called, for example, a "geometrical and military compass."

It was the sector that formed the main computing rival to the slide rule up into the later 18th century. Even well into the 19th century the sector was often included as a "standard instrument" with navigation equipment and drafting sets.

Now note that the slide rule and sector are in many ways analog computers, whereas Pascal's machine was digital with the use of digital discs and gears. Gears are really digital friction wheels.

The greatest of all geared calculatin' machinery was Englishman Charles Babbage's Grand Digital Computer. This was to contain more than 20,000 gears. It was never completely built though a working four function computer section was constructed. This device (conceived during the late 1860's) was to be a full fledged computer. The machine was to be programmed to computer specific problems. If it needed certain data, a bell would ring, the machine would stop and read out information would tell the operator what stack of IBM-type cards to insert in the card reader. After inserting these cards the machine would then continue until either the problem was solved or more "subroutines" stored on cards were required. Bear in mind now that this machine was considered for construction in the 1870's.

In point of fact Babbage had borrowed the card reader and card data storage technique from an early 1800 tapestry weaving machine constructed in France. With cards holding the "data" to weave exotic multicolored picture and pattern tapestries, a non-skilled person could weave a tapestry of rare beauty. Therefore, unskilled laborers could compete with skilled tapestry people. The skilled weavers organized a "computer riot" and a mob wandered all over Paris taking hatchets to the "computerized" weaving machines. The mob also hoped to meet the "IBM" programming-card inventor, but he slipped out of Paris into the countryside in disguise.

So new machines that allow unskilled people to do skilled tasks are really nothing new, nor is the human mistrust regarding them. It is this problem of data storage and "preprogrammed" subroutines that have been with human history for thousands of years.

Any clock that plays chimes contains a "read only" memory activated on the hour by the timing mechanism. Carillions are large bell ringing mechanisms that can play whole songs on huge church bells of various notes. Again the "read only" memory is obtained from a "pin barrel" or cylinder with pins as the memory device. The cylinder is rotated at constant speed and the pin location in relation to the other pins tells (1) which bell and (2) when to play it. It is only since the invention of the phonograph that recorded live music was available to anybody at all, rich or poor. Prior to that time almost *all* music which was mechanically reproduced was "preprogrammed" note by note in some type of "read only" memory.

It is also only with the invention of the electric motor and electric power distribution that any simple cheap mechanism to power the pin barrel and playing mechanism became available. All music boxes, clocks, carillions, etc. used either (1) stored energy in a spring or (2) stored energy in raised weights to power the system. If you have ever seen a cylinder style music box, note that there is a flat piece of metal whirling around down at one end of the cylinder when the machine is playing. That, and the three gears associated with it, are just there to beat the air and help control the speed of rotation of the pin barrel. Basically then, it is the "master clock" regulator for the "read only" memory!

Remember that Edison's first phonographs were cylinder types—basically copies of cylinder music boxes with only a new form of "read-write" memory. He could use the then existing spring motors of music boxes to power it. Later, it was the music box industry that went from cylinders to flat metal discs because they were easier to change and more rugged (and cheaper). Phonographs followed, with spring motors more readily available in that latter style. Then they discovered that both sides of the disc could be used! The "floppy disc" memories for large computing centers can trace their origin to the Polyphon Music Box Company! But most of the music box companies died around 1890 to early 1900 as a result of the improved memory technology.

Where music boxes represent "digital technology" and playback mechanisms used for music, analog storage information technology has also been employed. For centuries, unusually shaped cams have been traditional analog memories. When thinking of cams, many people think only of auto engines which do contain cams, but here we are talking of truly exotic devices. Several hundred years ago the hottest thing in analog music was the warbling bird. A small slide whistle was used to create the sound. The position of the sliding plunger determined the pitch, and a tiny flap valve cut off air flow to the whistle. Since the slide valve could be positioned by an analog memory (a cam), then notes of changing pitch could easily be produced. A spring motor working a bellows provided air power. While the flap valve could also be rapidly cut in or out, the warbling sound was reproduced. All the popular birds known to Europe were mechanically reproduced. Such warbling birds were even fitted in pocket watches, so when the lid was opened a folding bird flipped up and sang the time!

Bigger versions of warbling birds (in fact, full size birds) were constructed. Most were set in cages with the cam mechanism hidden in the cage bottom. In these large versions the birds were made to move, flap their wings, turn their heads, and warble away. All ran from "read only" analog cam memories. In some of the most complex types the bird flew (or appeared to fly) around the cage while singing. Actually they were supported on thin hollow rods run

Branch to . . . pg. 61

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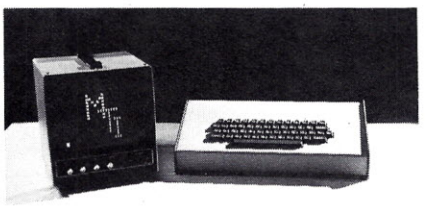
New Products



CIRCLE NO. 90 ON INQUIRY CARD

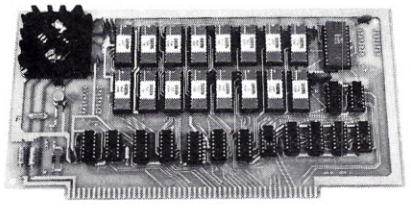
MICRO-TERM INC. INTRODUCES ACT-I DUMB TERMINAL

The ACT-I (affordable computer terminal) by MICRO-TERM INC. features 64 characters by 16 lines at the very attractive price of $400 for the terminal or $525 for the terminal and high resolution 9 inch monitor.

The modern 53-key electronic keyboard with 2-key rollover supports the full ASCII character set. A special "page" key permits the entire display to be cleared locally.

The ACT-I operates in full duplex mode at positive or negative logic levels including current loop, TTL or RS232C. Word format is standard 11 bits: 1 start, 7 ASCII data, 1 parity (odd/even or defeat high/low), and 2 stop bits.

Direct further inquiries to Micro-Term Inc. P.O. Box 9387, St. Louis, Missouri 63117, (314) 645-3656.

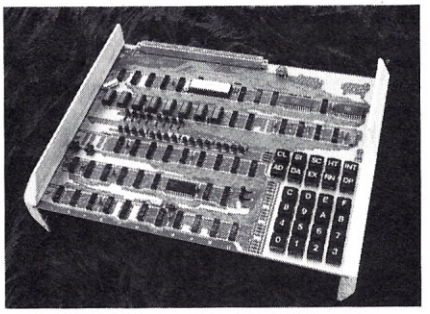


CIRCLE NO. 91 ON INQUIRY CARD

8KM 8K × 8-BIT LOW POWER STATIC MEMORY BOARD

Electronic Control Technology's 8KM Memory Board is plug compatible with the Altair 8800 and the IMSAI 8080 and can be used with other 8080 based systems. The 8KM is designed to meet the Altair specifications of less than 500 mA out of the 5 volt supply (typically 150 mA) and no more than 1 low power TTL load on each bus line per card. All signals to MOS devices are buffered by low power TTL to prevent damage by static at the edge connections.

For further information contact Electronic Control Technology, P.O. Box 6, Union, New Jersey 07083.



CIRCLE NO. 92 ON INQUIRY CARD

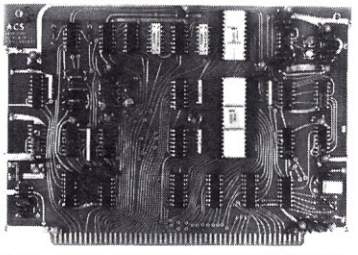
WESTERN DATA SYSTEMS OFFERS DATA HANDLER KIT

Western Data Systems has just introduced a new microcomputer called the DATA HANDLER. It combines the MOS Technology 6502 microprocessor with the latest state-of-the-art technology producing a high performance microcomputer at a price anyone can afford.

The high speed operating capabilities of the Data Handler are enabled by the use of an easy to use full function hardware controlled front panel, a large ground plane area (to minimize noise at high operating speed) on the P.C.B. and 2102 type RAMS.

This new dynamic microcomputer is at the lowest price ever. For an introductory offer the Data Handler Bare Bones kit is being offered for $79.95.

For complete information on ordering, write to Western Data Systems, 3650 Charles St., Suite Z, Santa Clara, Calif. 95050. (Introductory offer expires Aug. 31, 1976)



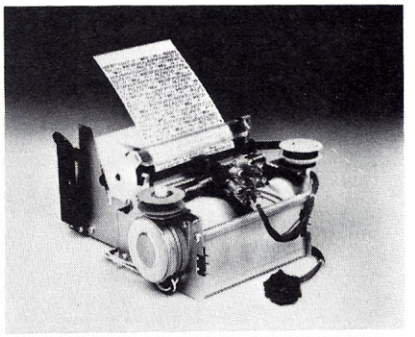
CIRCLE NO. 93 ON INQUIRY CARD

LOW COST MICROPROCESSOR PCB MODEL No. ACS-4040 MPU

The ACS-4040 MPU PCB is a parallel 4-bit general-purpose PCB mechanized around Intel's 4040 CPU IC.

Functional Organization. MPU functional sections include a 4-bit CPU, crystal clock timing, 8 bank RAM addressing, 2 bank PROM addressing, 8-bit program instruction buffered expansion bus, 13-bit PROM I/O address buffered expansion bus, RAM bidirectional memory data expansion bus, I/O bidirectional buffered expansion bus, Run/Single-Step mode control, Single Step, photo isolated local/remote power reset and master reset. On board bus control logic is provided to interface with an optional Program Development Control and Display Panel module.

For further information contact R. A. Stevens, Automated Computer Systems, 2361 E. Foothill Blvd., Pasadena, CA 91107 Telephone (213) 449-0616.



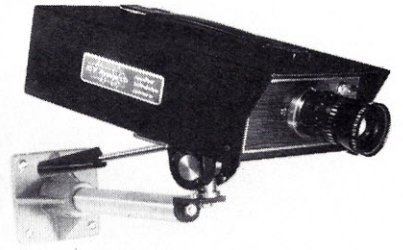
CIRCLE NO. 94 ON INQUIRY CARD

NEW LOW COST ALPHANUMERIC PRINTER ANNOUNCED

C. Itoh Electronics, Inc., 5301 Beethoven Street, Los Angeles, California 90066, announces a new line of alphanumeric printer, Model 7040L, in Microcomputer Terminals, Instrumentations, Data Loggins and other areas of application. The printer employs dot matrix techniques with 7-wire dots and has 40-column capacity, 1.25 1/s printing speed, and the ability to print large characters of variable density and shape, totally under software control.

Prices range from $76.00 to $185.00, F.O.B. Riverton, Wyoming or Los Angeles, California, depending upon quantity. Sample delivery is from stock. Quantity deliveries are approximately 6 to 10 weeks.

Contact: Ken Hidaka or Mike Niizu, C. Itoh Electronics, Inc., 5301 Beethoven Street, Los Angeles, California 90066. Telephone (213) 390-7778, Telex W.U. 65-2451.



CIRCLE NO. 95 ON INQUIRY CARD

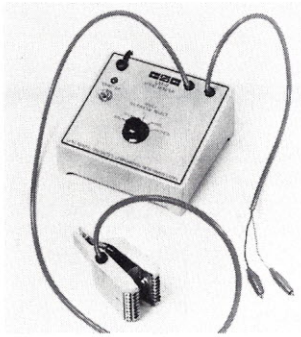
NEW T.V. CAMERA FOR COMPUTER PICTURES AND HOBBYIST APPLICATIONS

ATV Research announces a new solid-state closed-circuit TV camera specifically designed to meet the special requirements of computer buff and hobbyist.

Highlight features of the new Model XT-1A-DF camera include higher sensitivity, wide angle of view, special integrated circuitry for improved focus over extended periods of time, automatic light compensator and optional built-in silicone heater with solid-state thermostat.

As with all ATV Research cameras, the XT-1A-DF works on any TV set without modifications and runs on regular 120vac power.

Complete data sheet, photo, prices, televised picture and some commonly asked questions and answers are enclosed. For additional details or technical assistance please contact Mel Shadbolt at ATV Research, 13th & Broadway, Dakota City, Nebr. 68731. Telephone 402-987-3771.



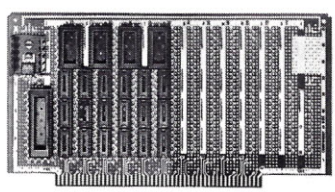
CIRCLE NO. 96 ON INQUIRY CARD

CONTINENTAL SPECIALTIES CORPORATION INTRODUCES THE LOGIC MONITOR-2 LM-2

Second Generation Logic Monitor from Continental Specialties offers greater versatility and accuracy.

Logic Monitor 2, a second generation digital test instrument incorporating a fully isolated power supply and selectable trigger threshold which matches the precise characteristics of the logic family under test has just been introduced by Continental Specialties Corporation of New Haven, Connecticut. The LM-2, which lists at $125.00, consists of two units—a connectors/display unit which clips over the IC, and a power supply module, which contains the precision reference power supply and logic family selector switch. LM-2 offers a fast, economical and extremely accurate method of checking out the static and dynamic states of dual-in-line-packaged IC's of up to 16 pins. Because it displays 16 channels of information simultaneously, it can show the user far more than an oscilloscope, and it's always automatically in sync.

By helping the user monitor the input and output of logic elements, problems of all types can be easily located and identified. For further information, contact Continental Specialties Corporation, 44 Kendall Street, Box 1942, New Haven, Ct. 06509 (203) 624-3103.

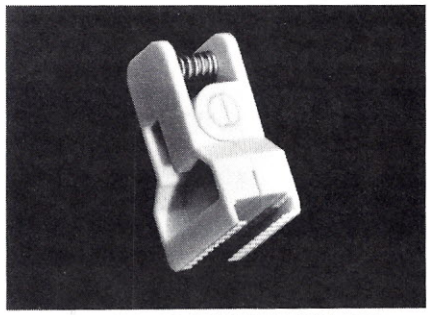


CIRCLE NO. 97 ON INQUIRY CARD

NEW UNIVERSAL MICROPROCESSOR BOARD HAS WIDE RANGE OF MOUNTING CAPABILITY

A new universal microprocessor board, from Vector Electronic Company, lets Altair, IMSAI and other microcomputer users add circuits in a convenient and inexpensive manner. One universal board, identical in size to those used in the Altair, serves for RAM, ROM, or PROM memory expansion, for peripheral interface hardware requirements, or for I/O circuits such as A-to-D, D-to-A convertors, multiplexers and relays. The board's 53.13 sq. in. area and 100 I/O terminals allow its use with any microprocessor-based system.

Vector Electronic Company, Inc., 12460 Gladstone Avenue, Sylmar, California 91342; (213) 365-9661, TWX (910) 496-1539.



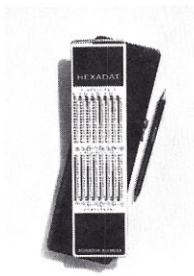
CIRCLE NO. 98 ON INQUIRY CARD

CAMBION ADDS .600 INCH DIP IC INSERTION/EXTRACTION TOOL TO COMPONENT LINE

Cambridge, Mass.—A new DIP IC insertion-extraction tool designed to be used with .600 inch wide integrated circuit packages is now available from CAMBION, a leading manufacturer of high quality electronic components. Utilizing a spring-loaded clothespin type action, the new tool securely grips the IC between the leads and under the body so the fragile leads of the IC are not damaged during insertion or removal.

The new .600 inch DIP IC tool is available from stock at a cost of $1.50 each singly or $1.05 in lots of 100. Cambion part number is: 706-3733-01-00-00. The new tool supplements a previously introduced unit (Cambion part number 706-3739-01-00-00) for conventional 14 and 16 lead DIP's with .300 inch wide construction.

Orders can be placed directly with the manufacturer: Cambridge Thermionic Corp., 445 Concord Avenue, Cambridge, Mass. 02138.



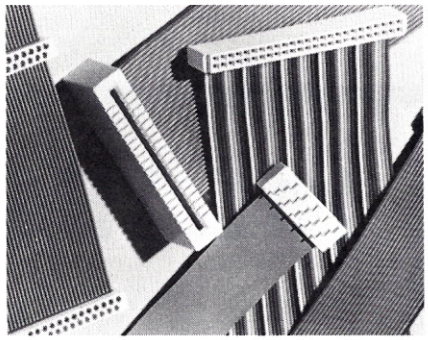
CIRCLE NO. 99 ON INQUIRY CARD

NEW HEXADECIMAL CALCULATOR

Atlanta, Ga.—Radix Precision Co. has introduced HEXADAT, a new pocket-size calculator that adds and subtracts hexadecimal (base 16) numbers used in computers. Capacity is eight hexadecimal digits. The machine is an aid to programmers, particularly hobbyists working with a microcomputer at the machine language level.

HEXADAT can subtract to a credit balance, and automatically gives the negative totals in red. The complement of a positive total, useful in determining unused memory, is also automatically given in a special row of answer windows. Conversions from decimal to hex and hex to decimal are made by the machine with the aid of a copyright conversion table.

HEXADAT, complete with leather zipper case, is $35.95 from Radix Precision Company, P.O. Box 13861, Atlanta, GA. 30324. Shipment is from stock.



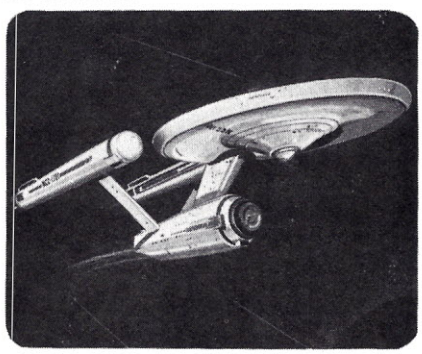
CIRCLE NO. 101 ON INQUIRY CARD

NEW FLAT RIBBON JUMPERS FEATURING MOLDED-ON CONNECTORS AND FACTORY TESTING

Available now from AP Products Incorporated, a directly interchangeable, fully assembled jumper line that is a cost effective alternate to the customer assembled mass terminated flat cables.

Three basic end terminations are available—these are socket connectors, printed circuit board connectors, and card-edge connectors. Each of these termination types is offered in the five most standard widely used sizes; 20, 26, 34, 40 and 50 contacts. With the types and sizes listed AP offers 60 standard single end configurations and 135 double end configurations. Additionally, AP can provided daisy chain assemblies tailored to customer requirements using any mix of end termination types.

For more information contact Robert J. Gabor, AP Products Incorporated, Box 110E, Painesville, Ohio 44077. Phone (216) 354-2101, TWX: 810-435-2250. Direct all inquiries to Rita Mercer.



CIRCLE NO. 102 ON INQUIRY CARD

PATCHABLE STAR TREK/SPACE WAR PROGRAM OFFERED

A version of the STAR TREK/SPACE WAR computer game is now available for the ALTAIR 8800. It is written in ALTAIR 4K BASIC and is available from International Data Systems, Inc. The purchase price of $10.00 (checks OK) includes a complete program source listing, operational instructions, tips on how to "patch" the program to add your own features, a one year limited warranty against "bugs," and postage and handling. The limited warranty states that a corrected copy will be provided if any errors are identified. Orders should be addressed to Star Trek Offer, International Data Systems, Inc., Post Office Box 593001-AMF, Miami, Florida, 33159.

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CIRCLE NO. 17 ON INQUIRY CARD

Cassette Tape Format Standards

by Charles H. Eby

Many articles have been written and many discussions held concerning cassette data formats. However, most of these have been concerned with the electronic techniques to be used in recording. This article is intended to approach the problem of tape format standards. That is, the data to be placed on the tape, rather than the recording technique. After due consideration of the problem, I am proposing the following standards for use in our systems.

Tape Files

In order to be able to record and maintain more than one "DATASET" of information on a tape, it will be necessary to separate and identify "FILES" of data or programs, each file containing an associated collection of data or a program.

Records

In general, since the data contained in any one file may be of too great a volume to be held in the computer memory at any one time, these files must be broken into "RECORDS," each record containing, for example, the equivalent of one line of data. This approach allows the processing of data one "line" at a time, thus drastically reducing the amount of computer memory necessary to operate on the data.

File Mark Records

In order to determine when the system reaches the end of a file of information, a special record must be recorded at the end of each file. This is commonly known as a "FILE MARK." The file mark can be considered to be both an indicator of the end of the current file and an indicator of the start of the next file. In addition, a special file mark can be defined to indicate the end of the last file on the tape, thus providing a position to begin recording any new data files.

Record Data Formats

Data (text) Records

Data (text) records are defined as those containing only text information with no special characters (other

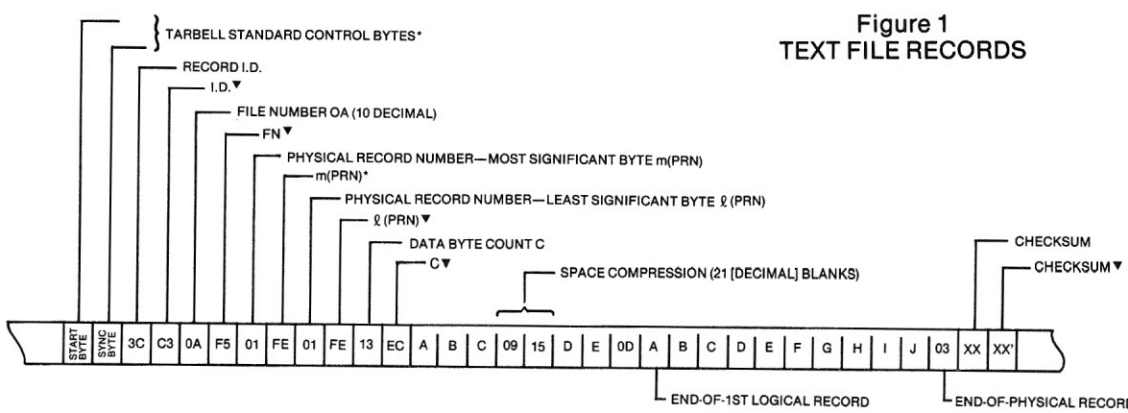

TARBELL STANDARD CONTROL BYTES*
RECORD I.D.
I.D.▼
FILE NUMBER 0A (10 DECIMAL)
FN▼
PHYSICAL RECORD NUMBER—MOST SIGNIFICANT BYTE m(PRN)
m(PRN)*
PHYSICAL RECORD NUMBER—LEAST SIGNIFICANT BYTE ℓ (PRN)
ℓ (PRN)▼
DATA BYTE COUNT C
C▼
SPACE COMPRESSION (21 [DECIMAL] BLANKS)
CHECKSUM
CHECKSUM▼
START BYTE
SYNC BYTE
3C C3 0A F5 01 FE 01 FE 13 EC A B C 09 15 D E 0D A B C D E F G H I J 03 XX XX'
END-OF-1ST LOGICAL RECORD
END-OF-PHYSICAL RECORD

Figure 1
TEXT FILE RECORDS

The record is a text file record in the 11th tape file (file 0A).

This is the 258th record of the file (physical record number 257).

The record contains 19 data bytes including 1 space-compression set, 1 logical end-of-record indicator and 1 physical end-of-record indicator.

NOTE: The first logical record, when expanded for use, will contain 21 spaces between the "C" and the "D." Logical record 2 does not end in this physical record (no OD exists), but is continued in the next physical record.

*Used by Tarbell Cassette Interface.

than text control characters < see Space Compression >). Typical examples of such files would be a name and address file or a file of program source statements. The following format is suggested as a standard format for this type record.

BYTE NO.	CONTENTS	DEFINITION
1	3C (hex)	Record I.D.—This identifier is used to differentiate data records from file mark records.
2	C3 (hex)	1's complement of the record I.D.—Used for verification of the record I.D.
3	FN	Logical FILE NUMBER of this data file. File numbers will start at zero (first file) and be incremented by +1 for each successive file. File number FF (hex) is reserved for special use (see FILE MARK End-of-Tape indication).
4	FN′	1's complement of FN—Used for FN verification during input.
5	m(PRN)	The most significant byte of a two-byte RECORD NUMBER of this record within the file (1st record is #0). This may be used by the system for tape positioning in conjunction with instructions to the operator to manually move the tape forward or backward using the normal FAST-FORWARD and REWIND controls on the tape unit.
6	m(PRN)′	1's complement of m(PRN)—Used for verification during input.
7	1(PRN)	The least significant byte of the record number.
8	1(PRN)′	1's complement of 1(PRN)—Used for verification during input.
9	C	Data Byte Count—The number of data bytes recorded in this record. This may be used by the system to determine when all data for this record has been read into the system.
10	C′	1's complement of C—Used for verification during input.
11-N	-data-	TEXT data bytes—The number of bytes (characters) is limited to 255 (by the 1-byte data count). This is also a convenient number of data bytes to process in that it comprises one "PAGE" (minus 1 byte) in the ALTAIR/IMSAI systems.
N+1	CS	The CHECKSUM over the data bytes—Used for data verification during input.
N+2	CS′	1's complement of CS—Used for verification of the checksum byte itself, during input.

Special Considerations for TEXT Files

TEXT datasets, in general, have two significant attri-

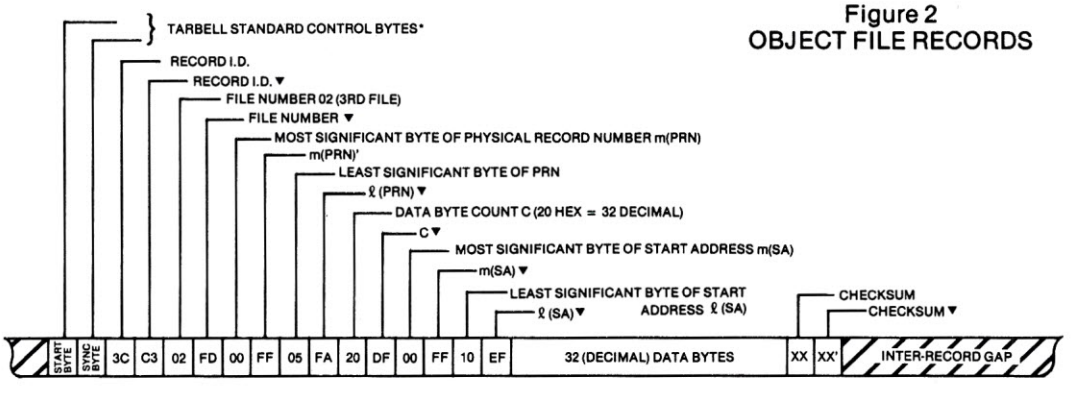

TARBELL STANDARD CONTROL BYTES*
RECORD I.D.
RECORD I.D. ▼
FILE NUMBER 02 (3RD FILE)
FILE NUMBER ▼
MOST SIGNIFICANT BYTE OF PHYSICAL RECORD NUMBER m(PRN)
m(PRN)'
LEAST SIGNIFICANT BYTE OF PRN
ℓ (PRN) ▼
DATA BYTE COUNT C (20 HEX = 32 DECIMAL)
C ▼
MOST SIGNIFICANT BYTE OF START ADDRESS m(SA)
m(SA) ▼
LEAST SIGNIFICANT BYTE OF START ADDRESS ℓ (SA)
ℓ (SA) ▼
CHECKSUM
CHECKSUM ▼
START BYTE
SYNC BYTE
3C C3 02 FD 00 FF 05 FA 20 DF 00 FF 10 EF
32 (DECIMAL) DATA BYTES
XX XX'
INTER-RECORD GAP

Figure 2
OBJECT FILE RECORDS

The record is an object file record in the third tape file (file 02).
This is the 6th record of the file (physical record number 5).
The record contains 32 data bytes (data byte count = 20 hex = 32 decimal).
The data is to be loaded into position 16 (decimal) in memory (START ADDRESS is 0010 hex = 16 decimal).

*Used by Tarbell Cassette Interface.

butes which, if not properly handled by the system, can and do cause significant delays in processing. These attributes are 1) the record (data line) lengths tend to be much shorter than the recommended maximum (255 bytes) and 2) text records contain significant numbers of blanks (space characters). In consideration of recording text data on cassettes, it becomes apparent that 1) records of near maximum length (255 bytes) are the best for recording since less tape space (hence less tape movement) is wasted in the "INTER-RECORD GAPs" (the gaps between data records which allow for tape starting and stopping) and 2) the recording of large blocks of blank characters is a waste of time and tape.

The above problems can be overcome through the implementation of two data processing techniques:

SPACE COMPRESSION—Multiple blanks (more than two), when encountered (in text data about to be written to tape), can be replaced by a special character [09 (hex)] followed by a 1-byte count of the number of blanks replaced. Upon input, the 09 is recognized as a space compression character and the blanks can then be reconstructed.

RECORD COMPRESSION—The problem of short records can be solved through a technique known as Record Compression. In using this method, a special character [0D (hex)] is used to indicate the end of a "LOGICAL RECORD," while the data read from and written to tape is a "PHYSICAL RECORD" and is terminated by a different special character [03 (hex)]. This requires that a portion of memory be set aside to hold the Physical Record during processing. Subroutines are used which allow the using program to "think" that it is actually writing (or reading) real records, while in reality, the subroutines are FETCHING data from or PUTTING data to the memory "I/O BUFFER." When the data in the current Physical Record is exhausted, the subroutines automatically read a new record of data into the I/O Buffer. However, this operation is transparent to the user program.

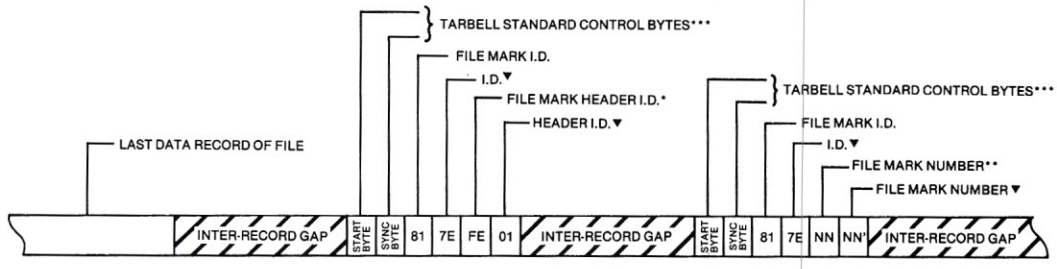
It must be noted that, while saving tape space and tape movement time, the subroutines needed to perform the above functions would seem to require extensive computer time. However, in practice, the amount of time needed by the machine to perform the functions is negligible when compared to the time spent in waiting for tape reading and writing.

Object File Records

Object file records are defined as those containing executable programs. Such files are produced from assembled programs or programs which have been "keyed" in. A significant attribute of such programs is that they must be loaded into a particular location in memory in order to properly execute. In addition, such records may contain any characters (byte configurations). This is obvious considering that 8800 machine code instructions are made up of byte values 00-FF (hex). The following format is suggested as a standard format for this type record.

BYTE NO.	CONTENTS	DEFINITION
1	3C (hex)	Record I.D.—This identifier is used to differentiate data records from file mark records.
2	C3 (hex)	1's complement of the record I.D.—Used for verification of the record I.D.
3	FN	Logical FILE NUMBER of this data file. File numbers will start at zero (first file) and be incremented by +1 for each successive file.

Figure 3
FILE MARK RECORDS



*The File Mark Header I.D. identifies this record as the first physical record of the File Mark.

**The File Mark Number corresponds to the file number in data records of the following file—or, if the File Mark Number is FF, indicates the last File Mark on tape.

***Used by Tarbell Cassette Interface.

		File number FF (hex) is reserved for special use (see FILE MARK End-of-Tape indication).
4	FN′	1's complement of FN—Used for FN verification during input.
5	m(PRN)	The most significant byte of a two-byte RECORD NUMBER of this record within the file (1st record is #0). This may be used by the system for tape positioning in conjunction with instructions to the operator to manually move the tape forward or backward using the normal FAST-FORWARD and REWIND controls on the tape unit.
6	m(PRN)′	1's complement of m(PRN)—Used for verification during input.
7	1(PRN)	The least significant byte of the record number.
8	1(PRN)′	1's complement of 1(PRN)—Used for verification during input.
9	C	Data Byte Count—The number of data bytes recorded in this record. This may be used by the system to determine when all data for this record has been read into the system.
10	C′	1's complement of C—Used for verification during input.
11	m(SA)	The most significant byte of a two-byte record START ADDRESS into which the program code of this record is to be loaded. This is used by the system to automatically load programs into the proper memory locations for execution.
12	m(SA)′	1's complement of m(SA)—Used for verification during input.
13	1(SA)	The least significant byte of the START ADDRESS.
14	1(SA)′	1's complement of 1(SA)—Used for verification during input.
15-N	-DATA-	Program data bytes. The number of bytes (characters) is limited to 255 (by the 1-byte data count). This is also a convenient number of data bytes to process in that it comprises one "PAGE" (minus 1 byte) in the ALTAIR/IMSAI systems.
N+1	CS	The CHECKSUM over the data bytes—Used for data verification during input.
N+2	CS′	1's complement of CS—Used for verification of the CHECKSUM byte itself, during input.

File Mark Records (See Figure 3)

File Mark records, in general, are written both prior to data records (to identify the file to the system) and after data records (to indicate the end of this file and the beginning of the next). The following is suggested as a standard format for this type record.

For audio cassette systems, a file mark must actually consist of two physical records. This is needed in order to rewrite file marks when the need arises. The techniques for doing this will be detailed in a future article, "CATALOGUED TAPES—An Operating System Concept."

File Mark Record 1

BYTE NO.	CONTENTS	DEFINITION
1	81 (hex)	Record I.D.—This identifier is used to differentiate file mark records from data records.
2	7E (hex)	1's complement of the record I.D.—Used for verification of the record I.D.
3	FE (hex)	This byte identifies the record as the first record of a file mark "set."
4	01 (hex)	1's complement of byte 3—Used for verification during input.

File Mark Record 2

BYTE NO.	CONTENTS	DEFINITION
1	81 (hex)	Record I.D.—This identifier is used to differentiate file mark records from data records.
2	7E (hex)	1's complement of the record I.D.—Used for verification of the record I.D.
3	NN	File Mark Number—This is used to identify the File following this File Mark. The number of the File Mark is the same as the File Numbers in the records of the following file.
4	NN′	1's complement of NN—Used for verification during input.

NOTE: File Mark number FF (hex) indicates the last file mark on the tape (END-OF-TAPE indication). No data follows this file mark. Thus, as previously mentioned, this special file mark may be used by the system to begin writing a new file.

Conclusion

The above techniques are adaptations of standard tape recording methodologies used in the industry. Any comments or suggestions will be welcomed by the author. ◘

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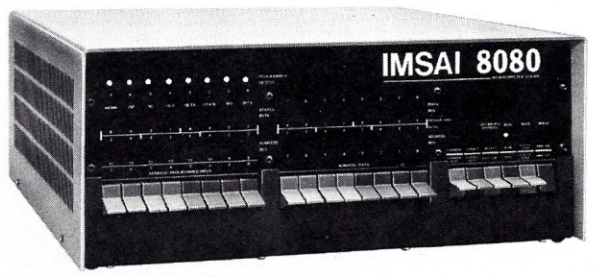

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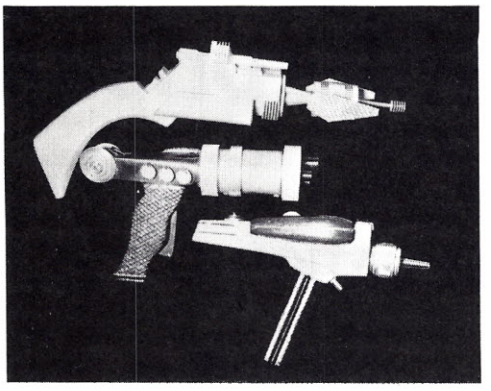


LARGE SCALE SYSTEMS

SOFTWARE CHOICES FOR STAR TREK

by Ralph Klestadt

Imagine a system running a Star Trek program with 64 terminals all interconnected, each having its own planet and forces to control, and each having wars and sharing resources. The hardware in large scale systems makes this quite possible, but the appropriate software you use can be chosen only after reviewing the choices available. Let us examine a fairly good cross section of available software on which a system like this could be written.

BASIC

BASIC is probably the most commonly used language for writing Star Trek and other game programs. It contains facilities for handling strings, but what about the mathematical qualities of BASIC? For most of the applications found in this category of programs, it is quite adequate. But the problem comes in when you want to go to a multi-user system. The Star Trek program in BASIC which the author has been using, has been on a DECsystem-10. This system is capable of inter-user communication, but not via any of the BASICs available on the system, and there is quite a variety. However, a new approach is being studied. This is to write relevant data (number of torpedos, energy, etc.) into a data file which is protected so that another user's program may access it. The second user's program then reads the data written into the sharing file and acts upon it. This system sounds fine until you get to execution speed. BASIC is not particularly slow by nature, and large systems such as the 10 can execute it rapidly. Yet with so many read/writes being done, it would definitely slow down the execution. With the addition of more users of the program, execution slows down even further. The only other method would be a re-write of the BASIC language, and the author doesn't need a Star Trek program that bad!

FORTRAN

FORTRAN may be less in use than BASIC for writing this type of program on minicomputers, but it is commonly used on large scale systems because of its many advantages. Using the DECsystem-10 running FORTRAN-10 and XF4 some of the advantages include easier debugging, faster execution, and easier sharing between users. Easier debugging results from the program FORDDT (FORTRAN Dynamic Debugging Technique) which the BASIC operating systems do not currently offer (anybody want to write one for the 10?). Because FORTRAN is a compiler, it results in faster execution. Another advantage is the result of assembler routines from FORTRAN compilation. These routines may be modified so the user's program gives the appearance of doing things in FORTRAN which can only be done in assembler like interrupting escape characters. For ease of sharing between users FORTRAN really shines. Because of the versatility of the COMMON statement, this offers an elaboration of the previous system explained under BASIC.

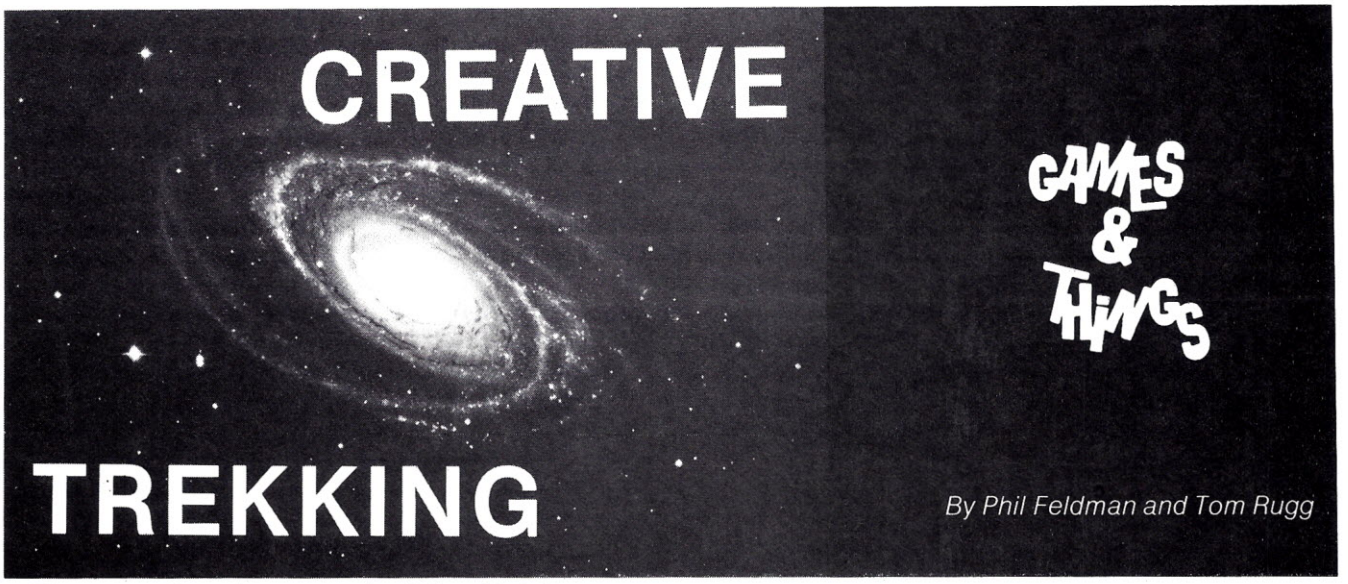
There are some difficulties to overcome using FORTRAN, however. In the opinion of many it is more difficult to write a program in FORTRAN than in BASIC. String handling also is more complicated. Despite these difficulties, in most cases the advantages outweigh the disadvantages. In weighing the good points against the bad, the user will find that FORTRAN poses a very viable solution for writing a Star Trek program.

PL/1

Programming Language/One and all of it's subsets, PL/C, PL/1X have always been a unique set of languages. Let us examine how a Star Trek program could be written in this language set. I am using PL/1X since a detailed version of Star Trek written in PL/1X is available to me for use on an IBM System/370 158. This version of Star Trek has several enhancements over both of the previously discussed Star Treks. One is the ability to save game data for future use, and another is an enhanced instruction set. Some of the more advanced instructions might be hyperspace jumps, time portals, and control over lifeboats. PL/1 offers an interesting combination of the ease of string operation of BASIC, and the nice features of FORTRAN, such as external program calls and advanced arithmetic procedures. Another notable asset is its speed. The program which the author has access to is 43 pages long, yet only takes 6 CPU seconds. This is relatively fast compared to other programs of similar length.

Yet PL/1 has some of the disadvantages of COBOL, like declaration of variables which can often become a pain. This is unlike BASIC where the user does not have this problem. Another problem is that PL/1 can only be used on some systems, unlike BASIC which is available on most large scale systems and most minicomputers. The main problem with PL/1 is that it is not available on all large scale systems.

Branch to . . . pg. 62



The oncoming of computerized Star Trek has provided quite a creative outlet for program designers. Many versions have been written in several different languages for many different machine configurations.

This month we will survey what has been done and look into some new ideas. Perhaps you have thought of writing your own version or modifying one you already have access to. We hope that food for thought will be provided for those of you who decide to embark on this Enterprise (so to speak).

Elsewhere in this issue is a featured article on a Star Trek game written by Lynn Cochran. His version was written in MITS 8K Basic and just fits in a 12K Altair 8800 system. This program provides all the basics of good Star Trek gaming within a limited system configuration. If you're not familiar with Star Trek computer games, read that article now to learn the ins and outs of phasers, long and short range scans, Klingons, and other essential buzz words.

But now suppose we have more core memory or a more sophisticated configuration to work with. How can we improve the game? What design decisions will we have to make?

One of the simplest ideas, often overlooked, is the addition of symbolic input and increased written output. For example, when asked for a command, typing in "PHASERS" or "MOVE" is much more realistic than "4" or "1" and is certainly easier to remember. Imagine the real Captain Kirk (there *is* a real one, isnt there?) thinking over his next command and finally announcing "3".

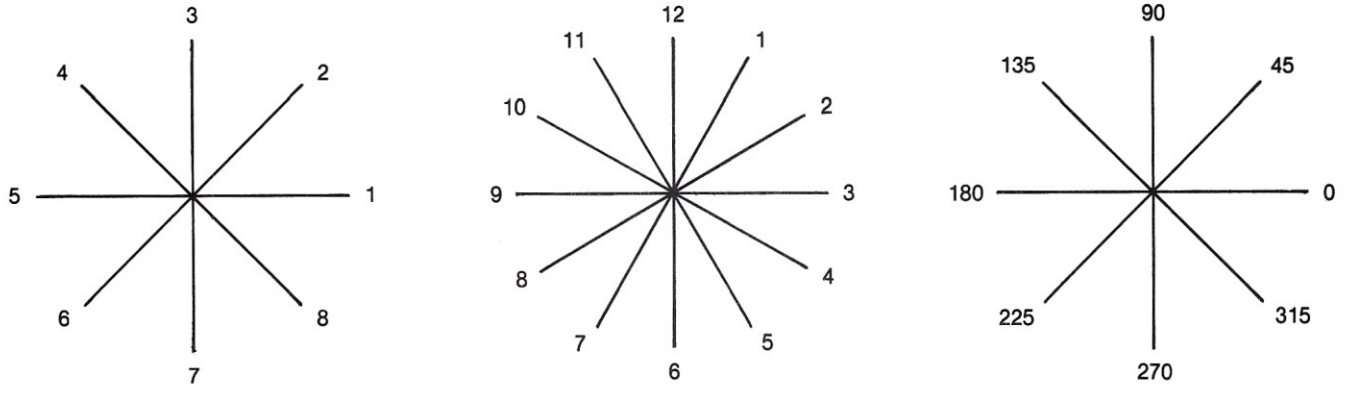
Generally, the more output (and the more entertaining it is), the better. For example, when a typo or incorrect command is entered, instead of just reprompting, try coming back with "BEG YOUR PARDON, CAPTAIN?".

MOVEMENT

One of the fundamental decisions to make in creating a Star Trek program is how large your known universe will be and what kind of movement will be possible within it.

Most games use a two-dimensional universe divided into quadrants and sectors (usually 8 × 8 or 10 × 10). Moving requires a course (or direction) and a speed (or a distance) in warps. The three most popular ways of indicating direction are shown in Figure 1.

The "circle" type is probably the simplest to use and is easy to remember by the player. For types A and B, mid-directions are usually computed linearly (not trigonometrically). For example, two sectors to the right and one up is 1.5 in the compass type and 2.25 in the clock type.



A. "COMPASS" TYPE B. "CLOCK" TYPE C. "CIRCLE" TYPE

Figure 1.
NAVIGATIONAL MAPS

Distances may be measured linearly (requiring 1 warp across a quadrant in a horizontal or vertical direction; 1.414 warps in a diagonal direction) or along an "L1" space (where distance is the greater of the horizontal and vertical directions involved). The latter means that each quadrant is effectively one warp long in every direction.

Moving requires energy, of course, and the longer the move, the more energy expended. Also, the stardate advances as the move is made. Some programs remember your warp speed and subsequent moves may require a change in speed (in order to change direction, or because of damage to the ship). Now acceleration gets involved, which may be a big factor in energy expenditure—the larger the acceleration (or deceleration), the more energy required.

SHIELDS

The use of shields adds a great deal of realism. They are the Enterprise's first line of defense. Generally you can transfer energy to and from the shields up to their capacity. Shields are like sponges—they absorb more than their own energy in enemy fire. They are used in several different ways in different programs. Some examples:

1. If they are hit with more than they can handle, the Enterprise is destroyed and the game is over (even though plenty of energy might remain with the ship itself.
2. Breaking through the shields is not fatal, but causes severe damage to the ship—possibly including loss of crew members.
3. Shields can be raised and lowered. Defense is high when they are up, but certain weapons (usually phasers) cannot be used unless they are down.

COMBAT AND THE BAD GUYS

Now we come to the crux of the game—battling the guys in the black hats.

Figure 2 shows a typical example of the logic necessary in designing the combat portion of your program. This one is based on a program written in Fortran for the CDC 6500 by Barry Press of TRW Systems.

Any box with an R in the lower right corner indicates that the exact action performed will depend on the results of a random number.

In this program the Klingons can "cloak." When they do so, they are invisible and will not show up on a short range scan (which makes torpedo firing tough). Also, the bad guys have strategy. If more than one are in your quadrant, they will tend to move in closer and surround you. They are even nefarious enough to position themselves out of the direct torpedo lanes (the integral values on the navigational map)! How's that for cunning? The Klingons can move from quadrant to quadrant in this game and will always move toward you. If one moves into a quadrant you have previously long range scanned, it will be detected by a "buoy" you left there and reported to you. The Klingons will also launch attacks on starbases.

In this game, as in most others, firing photon torpedoes has the advantage of using very little energy. However, they can only be used to kill one Klingon and may misfire. Any other Klingons (or the one fired at but missed) will then have a free round of phaser fire at you. If a torpedo hits a Klingon, he is destroyed. Phaser fire will hit with a varying amount of force, depending on the Klingon's distance, the amount of energy used, and a random number. The energy which strikes the Klingon is subtracted from his energy supply and his subsequent fire power is reduced.

Some programs have Romulans hanging around also. In the above mentioned program, they do not engage in the war, but will let loose with "anti-matter destruction pods." These goodies are released indiscriminantly and hit anything in the way (Klingons or the Enterprise).

DAMAGE REPORTING

Increased game enjoyment (and frustration) is accomplished by keeping track of the condition of all the ship's facilities. Various things can cause damage to them, such as colliding with a star, sustaining a heavy attack, or random events (space storms, for example).

The state of the damages can be improved by docking with a starbase, the passage of time without catastrophe, or random events ("SPOCK USED A NEW REPAIR TECHNIQUE"). When damaged, a facility is rendered inoperative or unreliable. Typical facilities and the problems created include:

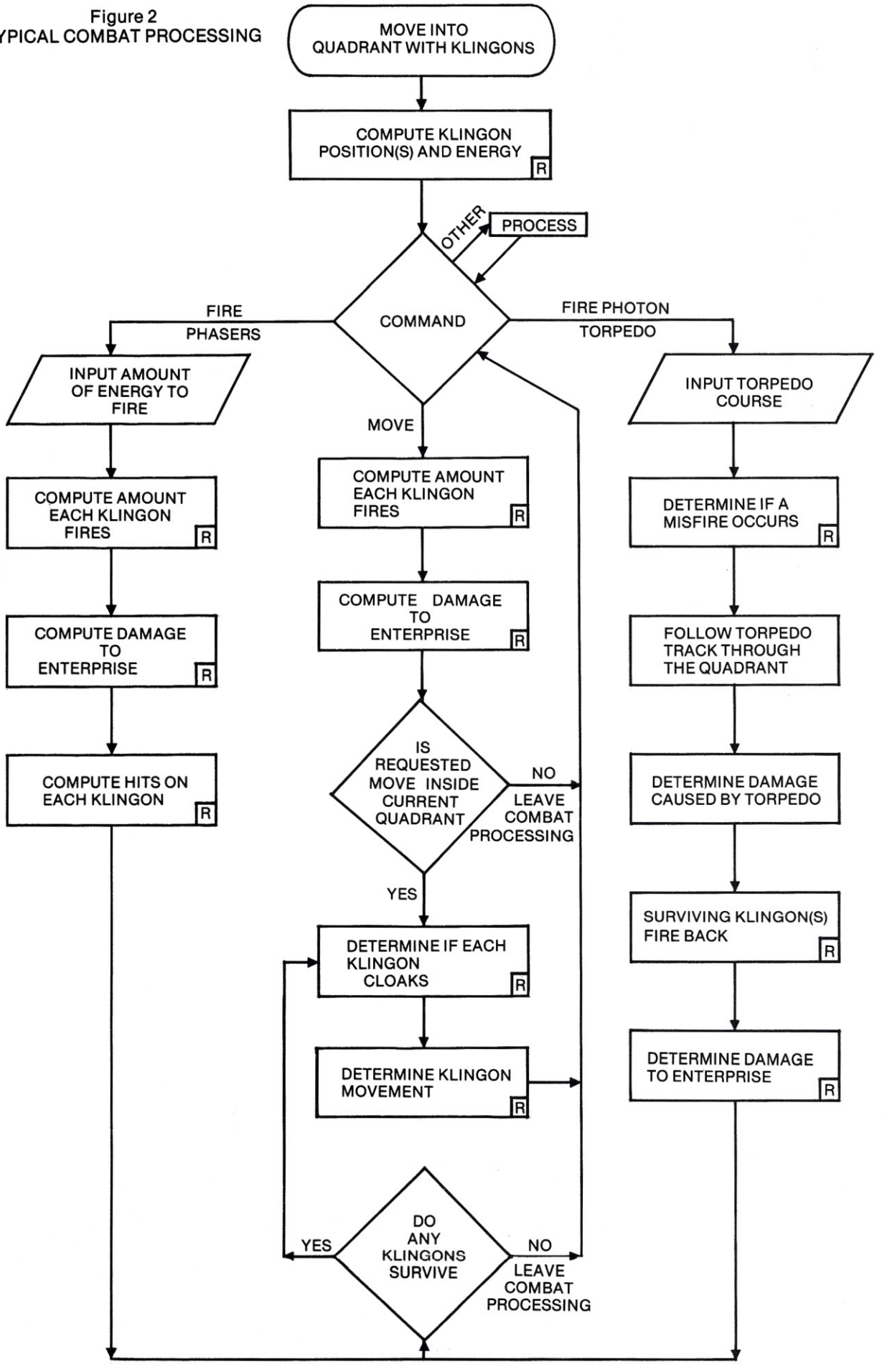
WARP ENGINES (only impulse power available—max. of warp 0.2)
COURSE GYRO (course direction becomes unreliable)
SHORT RANGE SCAN (becomes unusable)
LONG RANGE SCAN (becomes unusable)
PHASER CONTROL (phasers become unusable)
TORPEDO CONTROL (torpedoes become unusable)
SHIELD CONTROL (energy cannot be transferred to/from shields)
DAMAGE CONTROL (damage report becomes unavailable)
LIFE SUPPORT (crew may start dying off)

HOW GOOD A CAPTAIN KIRK ARE YOU?

Several Star Trek programs give you a numerical rating of your performance at the end of the game. This adds a lot of fun and competitiveness. Often the rating is combined with an initial input of some sort of degree of difficulty desired. Then the program adjusts its parameters according to the difficulty requested. A more difficult game may result in more Klingons, fewer starbases, less time for mission completion, less energy allotted to the Enterprise, increased Klingon intelligence, etc.

With these options you can chart your improvement and compare performances with friends (and enemies). Typical conversations overheard include: "I'm winning level 5 games consistently and level 6 games 70% of the time." Or, "That's nothing. I won a level 9 yesterday and had a rating of 1876."

Figure 2
TYPICAL COMBAT PROCESSING



A good model of these options is provided by a program written at the University of Texas at Austin by David Matuszek and Paul Reynolds. It's in Fortran and designed for CDC equipment. At the beginning you provide the length of game desired (short, medium, or long) and your skill level (novice, fair, good, or expert). Game parameters are set accordingly. At the conclusion, you are given a performance rating computed as follows:

RATING =

(10)	*	(number of regular Klingons destroyed) +
(50)	*	(number of Klingon commanders destroyed) +
(500)	*	(average no. of Klingons destroyed per stardate) +
(-5)	*	(number of stars destroyed) +
(-100)	*	(number of starbases destroyed) +
(-100)	*	(number of calls for help) +
(-1)	*	(number of crew casualties on board) +
(-100)	*	(number of ships lost) +
(-200)		(if you get killed) +
BONUS		(if you win)

The bonus is 100 for a novice, 200 for fair, 300 for good, and 400 for expert.

Some of these require explanation. Klingon commanders are a little more powerful than regular Klingons. Also, they do other nasties—like attacking starbases in a distant quadrant.

Calls for HELP result in the nearest starbase (even in another quadrant) attempting to dematerialize your ship and beam you to the base. This has its risks (you might not rematerialize) but does wonders for your energy supply and ship condition when it works. However, it lowers your esteem in the eyes of the Federation.

In this version, it is possible to abandon ship if destruction seems imminent. You can then escape in a shuttle craft. If you survive this, the Federation puts you in command of the Faerie Queene—an antiquated but still usable ship. Then you can continue the mission.

Winning is defined as destroying all the Klingons within the allotted time. In this game it is even possible to get killed and still win if, for example, you ram into the last Klingon.

The game features other interesting ideas. If you torpedo a star, it may become a nova and do great damage to everything in its quadrant. Stars can even become supernovas which will completely destroy everything in their quadrant—possibly even you and the last Klingons. Thus the Federation will exalt you posthumously.

Torpedoes can be fired in bursts of three spread over a small angle to increase the likelihood of hitting a target. Klingons have tractor beams which can pull you to them from another quadrant. You may even self-destruct your ship, but only if you can recall a secret password you entered at the beginning of the game. Also, you can get captured by the Klingons, which will result in torture or a possible prisoner of war exchange.

Several entertaining and useful messages are included. For example, a command to move a great distance at slow speed results in this message from Mr. Spock: "ARE YOU SURE WE DARE SPEND THE TIME?" If you perform a sucessful Kamikaze: "SINCE YOU TOOK THE LAST KLINGON WITH YOU, YOU ARE A MARTYR AND A HERO. SOMEDAY MAYBE THEY'LL ERECT A STATUE IN YOUR MEMORY. REST IN PEACE AND TRY NOT TO THINK ABOUT PIGEONS."

REAL TIME

If you have the availability of interrogating a real time clock during program execution, a whole new dimension opens up. A good example of this technique is a program written, rewritten, and/or modified by Vic Tolomei, Don Worth, Mike Stern, and unknown others. It comes by way of USC, UCLA, and points east. It's a combination of Fortran, PL/1, and 360 Assembler and was designed to run under IBM's TSO (Time Sharing Option).

Ships and torpedoes move in real time. If a torpedo is fired at you, it will show up in a short range scan. If you just twiddle your thumbs and then do another scan, the torpedo will be closer! No rest for the weary here. You must not only do the right thing, but you have to do it fast enough.

Things like ship and enemy movements will be controlled by the real time monitor. Acceleration is not instantaneous, but requires real time to accomplish. A quick dash to the bathroom may result in your demolition while you're gone. A degree of difficulty is accomplished by allowing the user to choose how closely to map the passage of real time into star dates.

NEW IDEAS

Creative new ideas are endless. Maybe you could take the universe out of Flatland and put it into three-dimensional space. Possibly we could open communications with the Klingons and try to negotiate—though who would trust one? (The USC-UCLA version does this to a limited extent.) How about mutiny, or intruders aboard the Enterprise diverting the Captain's attention to cost valuable time? Then there's the possibility of beaming down to planets and searching for useful things there—like new energy sources or intelligent friendly civilizations. Or how about . . .

Maybe you have some new ideas or know some interesting ones now implemented. If so, drop us a line. We are also interested in new computer games you've written or just comments about the column. This is one system that will definitely work better with feedback. Address all correspondence to GAMES EDITOR in care of INTERFACE.

STAR TREK MOVIE UPDATE

Moving from real time back to the real world (more or less), we have more bad news about the filming schedule for the upcoming Star Trek movie. It has been pushed back once more and is now expected to begin sometime in October or November. ◻

Bits & Bytes

by Mike Teener

Well, here we are again. Still no Altair 680 . . . or rather, 680B. It seems the 680 has already gone through a model revision before any have been delivered. I was told sometime ago that they would *for sure* be ready April 15th. As I write this, it's April 25 . . . and my spies tell me there wasn't even a working model at the WACC. Good Grief! I expected delivery to take a little longer than the 60 days the MITS people promised back in late November, but it's been five months. Hey, you guys out there in New Mexico, I love your BASIC and all that, but this kind of delivery schedule is pretty bad . . . even in the hobbyist game.

Oh well, that's life for you. I spend months making up my mind on which computer to buy, and then end up trying to get the one that makes me wait the longest for delivery. Twice in the past three months I used the money intended for the 680 to go on ski trips. MITS has given me some great vacations.

Actually, I really can't get my ire up too much. I know how projects like this work. I can just see the frustration and maddening delays MITS is going through now . . . the initial design doesn't look competitive, so the engineers frantically produce an updated version. In the hurry a few mistakes are made, which take a few weeks to fix. Then it turns out one of their chip suppliers has delivered a pile of below-spec buffers which won't drive the memory bus, and the second source just went bankrupt, and the TI version has ground and Vcc on different pins than the original design called for. On top of all that, the subcontractor building the front panels accidently used a particularly revolting shade of brownish-pink. Of course, I don't know what really happened, but it gives you an idea of how things can go wrong.

I wish I could report some new and startling development in the computer world this month, but I can't. The only thing of interest is that a lot of people are *finally* starting to become aware of the huge potential market for small, cheap, light-duty printers. Look for an under $500 printer operating at no less than 30 cps to be out before the end of the year. It will be a full 72 or 80 columns wide and directly attach to any RS232 interface. I don't know who will be bringing it out first, but the Japanese have some mighty good looking stuff right now that a few people are already beginning to use.

Oh, I almost forgot. National Semiconductor, one of the originals in the microprocessor game, is bringing out a vastly upgraded PACE. This one will be *six* times faster, making it more than competitive with the Intel 8080 . . . *and* it's a sixteen bitter.

Another sixteen bit processor is the MicroNova from Data General. Unlike the PACE, which is only similar to the Nova minicomputer, the MicroNova is 100% compatible to Nova and Nova 3 computers. So just like the LSI-11 and the TI 990, the MicroNova can run all the existing software, meaning Fortran, Algol, Basic, and a variety of real operating systems. Prices are about the same as the TI 990 that I mentioned a few months back . . . about $2000 for a workable system. If this kind of thing continues, we may all end up buying PDP-11s, TI990s, Novas or the like. So where is IBM . . . maybe the 370/tiny? ◻

LETTERS vectored from . . . pg. 9

Dear Sirs:

I picked up a copy of your mag two weeks ago while in California and was amazed to even know such a publication existed. Every article is just great. I am enclosing $10 for membership and subscription to SCCS INTERFACE. Hope to soon have a gang going on this side of the continent.

Rick Benet
1224 N. Lake Blvd.
Lake Park, Fla. 33404

Dear Rick:

Maybe you and Tom Turner of Coral Gables would want to get together. See "Update" for his address.

Editor

Branch to . . . pg. 57

IMSAI announces a unique 4K RAM board for just $139.

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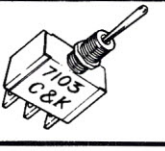

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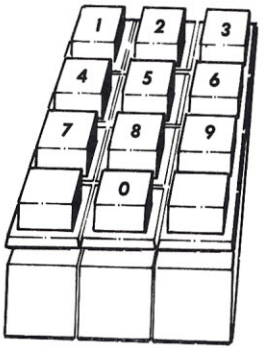

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CIRCLE NO. 19 ON INQUIRY CARD

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THE SOLUTION BOX by Polymorphics — the Micro Altair — it's a second generation computer! An example of its efficiency is expressed in the organization of the processor board itself. It has 512 bytes to RAM, room for 3K bytes of PROM, priority interrupt, real time clock, and can accomodate two (2) SIO ports or SIO and cassette. The video board below is included with each computer. $575.00, Kit and $795.00 fully assembled and tested.

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CIRCLE NO. 20 ON INQUIRY CARD

UP 'N RUNNIN'

by Stephen Tuenge

The name of the game may be 'up and runnin', but all too often the neophyte kit builder is faced with a computer that falls flat on its face and blinks out a steady stream of S O S's in some unintelligible language when the power switch is first turned on. Since it's often the case that the beginner has little to guide him on where to start or what to do next, we'll see if there is some help we can offer while we're waiting for reader response (this is to be an interactive column where readers may share their problems, cures, and little circuit tricks to make their computer work better. Send in your ideas, comments, or story to INTERFACE now—end of commercial). While there isn't time or space here to make anyone a computer doctor, a little first aid is within our scope.

Before getting into tools needed and setting up a simple troubleshooting procedure to follow, heed a few words of caution. First be sure that the manufacturer's directions are followed religiously and double check all component placement and IC orientation. Even though many kit suppliers do not include sockets for the IC's, sockets are worth their weight in gold when it comes time to troubleshoot. Socket all IC's.

The first steps in troubleshooting are quite simple and require only the tools used to assemble the board in the first place, and a magnifying glass or a loupe. With literally hundreds of solder joints on even a simple board, some of them with as little separations as the thickness of a credit card, it is very easy to inadvertantly solder two traces together or leave a cold joint. A thorough, joint by joint, trace by trace inspection will disclose most of the problems apt to be faced by the kit builder, since most of the kits are free of design errors and IC's very seldom fail. Most problems are caused by assembly errors that are relatively easy to find and correct. Once the board is certified free of solder blobs, lifted pads, cold solder joints, and any other ills that can befall a kit project, it's time to put it all back together and power up again. If, by chance, the board still does not function properly, there is still one easy check left to perform. After power has been on for awhile, shorted IC's and overloaded dropping resistors will be running quite a bit hotter than normal. It should be kept in mind that many IC's run warm all the time, but it won't hurt to try replacing any that seem too warm.

The next check for a board that is still bad only requires a VOM or a VTVM. Checking the power supply voltages when you know it's good may seem like a waste of time—'tain't so'. Until V_{cc} and any other required voltages are measured *at the pins of the IC's* you don't know, and just a few tenths of a volt can make a world of difference. Any discrepancies in supply voltage can usually be traced down and cured with ease.

Now the easy part is done and if there are still problems, the fun begins. To procede any further means obtaining a few tools and some understanding of logic circuitry. The first item that will be needed is a logic probe (See POPULAR ELECTRONICS, MAY 76) or even a simple light pen using an LED and resistor. A DIP clip is well worth the small expense when it comes time to get at the pins of the IC's, and while you're at it, pick up one of the small protoboards to build test circuits on. While a good ocsilloscope would make things easier it is not absolutely necessary, as all of the functions of a 'scope can be implemented with digital test circuits. Besides the essential items of hardware there is, just as in any other computer function, software to be acquired. The only problem is that the software must be stored in the troubleshooter's head, and be up and running.

Though even the small home computer is horrendously complex, almost all of the complexity comes prepackaged in neat little devices that either work or don't work. With most of the difficulty taken

out of the understanding of modern day logic circuits by the designers of the IC's, there is little electronics know-how a newcomer must learn in order to master the subject. In fact, all that's really needed is a knowledge of what all the 'black boxes' are supposed to do and how to connect them to achieve a desired function. There is one book that covers most of the information that the beginner need learn to understand his computer, and be able to fix it: Don Lancaster's TTL COOKBOOK (Howard W. Sams & Co.), sold at most electronics supply stores. The best bet is to get a handful of the IC's mentioned in the book and a power supply, and retire with the book to learn by reading and doing. It may take awhile to understand enough to be an efficient troubleshooter but the rewards for learning are high in terms of being able to properly implement a home computer once it is running.

Armed with a reasonable knowledge of logic circuitry, the place to start looking for any problems not screened out by the easy methods is at the schematic. Often the problem will give itself away by front panel indications. In any case, either from the front panel indications or the circuitry pointed to by the indications, the next step is a node (any connection of two or more inputs/outputs) by node check back to a point where the problem originates. The steady state logic levels with the computer, either running or stopped, are not too difficult to perform, but the dynamic, or pulsed logic, may, at times, require a little ingenuity to ferret out. By removing the inputs connected to the output of a logic gate (here's where the sockets pay off), it's not hard to determine which IC is causing the problems once the node where the first occurrence of a bad signal is isolated. (If the node checks bad with all the loads disconnected from it and the IC checks out OK, then its back to step one—some of those shorts are tiny.) A problem common to digital circuits that separates them from the older more familiar analog circuits is that there is no middle point at which to inject a signal, with the number of interconnections involved the only recourse, usually, is a point by point check looking for the correct logic levels.

Sometimes in a device as complicated as a microprocessor chip, the thing seems to work with a demented logic of its own, far removed from what the data sheets call for, and defying all reasoning. The solution to this type of problem is what this column is supposed to be all about—we'll let you know where to look for likely trouble spots and save much cursing on your part. For instance, if an Altair 8800 seems to check out but still performs as described above, it's likely the clock, even if it seems to check out OK and the crystal is working. Unless the timing relationship is within quite narrow bounds, the CPU won't function properly. The cause here could well be the 74123, even though it is good enough to work in most other circuits.

The field of computer logic, as it applies to the microcomputers used by most enthusiasts, is remarkable in that it is both a very 'high technology' field and one that the average amateur can master. Anyone in doubt can see for himself, by starting with the TTL COOKBOOK, that there is no mystery to the inner workings of the world's latest (greatest?) toy.

LETTERS vectored from . . . pg. 53

Dear Sir:

"53-4F-53" I desperately need direct contact with RGS-008A system owner who has his up-working and knows program entry process including: Cassette, keyboard, TTY interface (at least). Would like info on TVT-1 program for interface as well. All related expense would be gladly reimbursed. The system is basically sound. I've seen much of it working at RGS, but I couldn't get what I needed there before I moved.

Gerald McKee
Box 992
Okmulgee, Ok. 74447
Phone: (918) 756-2978

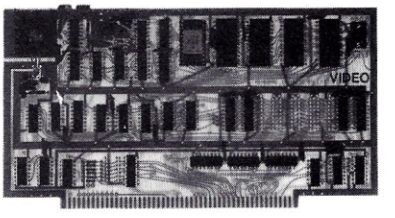
Dear SCCS:

I'm just entering into the microcomputer world and I know very little about electronics. I do have the confidence, however, to learn. I presently manage a large data processing unit 2-IBM 360/50's.

I'm also amenable to forming a chapter of your organization in this (S.E. Alabama) area.

John R. Griffin, MS, MBA, CDP
51 Endl Ave.
Ft. Rucker, Ala. 36362

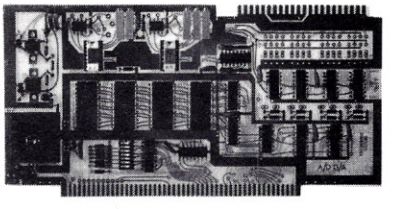
VIDEO TERMINAL FOR YOUR ALTAIR OR IMSAI



VIDEO TERMINAL INTERFACE

Connects to standard TV monitor (or modified receiver) to display 16 lines of 64 or 32 characters in a 7 x 9 matrix. Character set includes 128 upper and lower case ASCII characters and 64 graphic characters for plotting 48 x 64 (128 with memory option) array. Text and graphics may be mixed on the same screen. 8-bit keyboard input port is provided. Characters are stored in the onboard memory and may be read or written by the computer. Cursor control, text editing and graphics software is included. Fully compatible with Altair and IMSAI. Sockets included.

VTI/32 32 character line $185.00 kit
VTI/64 64 character line $210.00 kit $285.00 assd.



ANALOG INTERFACE

Complete interface for a CRT graphics display or X-Y plotter. Provides 8 channels of software-controlled A/D conversion. 1 or 2 channels of analog output with 10-bit resolution (0-10v or ±5v out). 6 bits of latched digital output, and 8 analog comparators. Software included for A/D conversion by successive approximation and tracking. Sockets included.

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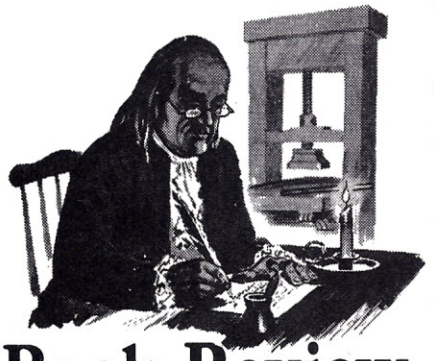
CIRCLE NO. 21 ON INQUIRY CARD



Book Review

SCELBI'S FIRST BOOK OF COMPUTER GAMES FOR THE "8008"/"8080"

Scelbi Computer Consulting, Inc.
1322 Rear—Boston Post Road
Milford, CT 06460

Price: $14.95

Reviewed by Walter M. White

Three games, fully annotated with machine language coding for both 8008 and 8080 microprocessors are included in this book written by Nat Wadsworth and Robert Findley.

For each game, a detailed description of the operation of each routine and subroutine is included. An assembled listing with 8008 machine codes is followed by an assembled listing with 8080 machine codes. How to use the programs include samples of the program outputs. Instructions in the programs themselves are kept to a minimum in order to conserve memory requirements.

"Hangman" is a computer version of the word guessing game where the player has eight chances to guess the letters in a word chosen at random by the computer from a list. Of course, the person generating the word list must be someone other than the player.

"Space Capture" is the most interesting and challenging of the three games presented. Played on an 8 × 8 grid, the player tries to surround a randomly moving space ship without destroying it. This reviewer was disappointed at the limited output of the program which required that scratch paper be used to keep track of past moves.

"Hexpawn" is not a game in the sense the first two are, but it is a simple lesson in artificial intelligence. The game itself is trivial. Played on a 3 × 3 chessboard, the computer and the player each have three pawns. The object is to move one of your pawns to the computer's side of the board while preventing the computer from doing the same to you. The interesting feature of this game is that the computer learns from its mistakes and will not repeat a move that led to a previous victory by the player. As the game progresses, it becomes increasingly difficult to beat the computer.

The book had some errors in the machine language listings, one of which would cause the hexpawn program to "hang up" by continuing to ask the player for a move when no legal move was possible. The errors can be corrected by studying the tables in the program.

An 8008 or 8080 based CPU and a teletype or CRT terminal are needed to play the games. The user must supply his own keyboard and output routines as I/O hardware and software differ from system to system. Since no high level languages are required, the hobbyist unable to afford a BASIC interpreter or extensive memory (no game uses more than 2K) can have a useful series of game programs for his machine. (8½ × 11 soft cover, 85 pages).

"GAMES WITH THE POCKET CALCULATOR"
By Sivasailam Thiagarajan
and
Harold D. Stolovitch
Dymax, $2.00

This book is one of the most exciting I've read in a long time—exciting because of the creativity reflected in the text. Perhaps it can best be described by reprinting a couple paragraphs and a game from the book:

"The calculator revolution is spreading rapidly. The popularity of these handy devices has caused a profound shift in the way we teach, learn, and use numbers. Almost every day there is an article in some magazine commenting upon this phenomenon. Many books have appeared on the market, including some which deal with calculator games. However, on closer inspection, these "games" turn out to be tricks and puzzles. In contrast, the games in this book fall within the classical definition of interactive activities. All involve an element of conflict and competition, with rules for making moves and ending the game. In addition, the two dozen games described in this book share these features:

1. You do not need an expensive calculator. A cheap "four banger" with a six-digit display will work fine. However, if you have a sophisticated and expensive gadget, you can come up with variations which provide more exciting options.

2. You do not have to be a mathematician to play these games. All the games permit people at different levels to compete on satisfactorily equal grounds.

3. You don't need one calculator for each player. You can share a single instrument with all your friends and opponents.

4. You do not have to wait a long time before your turn. The games are fast-paced and permit immediate replay without loss of interest.

5. You do not have to play the same game again and again. The two dozen games have sufficient variety to intrigue those who love numbers and those who hate them. Although most of them require devious strategy, some have an exciting element of chance. And, all of the games permit variatons so that you can add your own personal touch to come up with exciting new combinations.

BOOKS IN BRIEF

BUGBOOKS 1 & 2 (sold as a set at $17.00) are important reading for anyone not familiar with digital logic who wishes to keep up with developments in microcomputers and digital electronics. The books cover TTL logic and memory experiments . . . good "how to" books that are easy to read by anyone, regardless of background.

INSTRUCTOR'S MANUAL for Bugbooks 1 and 2 was written for you who experiment at home and need to know if you did the right thing, or if you answered the questions correctly. ($3.00)

BUGBOOK 2A, on UARTS (Universal, Asynchronous Receiver Transmitter) includes experiments, and teaches how a computer or terminal which outputs parallel digital information communicates with equipment that only accepts serial information.

BUGBOOK 3 covers interfacing and software requirements of the Intel 8080. It contains experiments for interfacing the 8080 to the outside world for control applications, but does not require hardware and "doing" to be a useful book to read. ($15.00)

All Bugbooks are published by E & L Instruments, Inc.

INTRODUCTION TO MICROCOMPUTERS" by Adam Osborne ($7.50) is an excellent reference book for understanding the architecture of all available microprocessors and the programming instructions. Objective in presenting the advantages and disadvantages of each type offered, this book contains a good section on the "History of Computers," and takes the reader to future of computers and microprocessors, and their applications.

For references to other publications, please see "Applications Exchange" by Larry Press, in this issue. ◻

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HARDWARE REPORT

By Scott Wilcox

Where do we go from here? The personal computer field is about a year and a half old and we have seen a lot of good hardware developed. Are we going to see some sort of breakthrough in the near future? "Microprocessor" is one of the hottest current buzz words in the electronics industry and there are a lot of people working on various microcomputer products.

At the recent ALTAIR users computer conference in Albuquerque, there was some great ingenuity shown in the exhibits. Prize winners included: a computerized Ham radio station, computer generated synthetic speech, and a computer directed backgammon game in full color on TV. With such divergent independent developments by "amateurs" it is exciting to imagine what the "professionals" are doing. The various manufacturers are not sitting idle. Almost monthly there are new products announced. At the ALTAIR conference, MITS formally introduced the new ALTAIR 8800b computer and a new 16K static memory card. Other new memories include an 8K static from Processor Technology and a redesigned 4K static memory from IMSAI. There are also rumors that IMSAI is developing a low cost dual floppy disc system for under $1000.

When the word floppy is mentioned, most hobbiest's eyes light up. Even if they don't say it, a lot of the home system users are at least thinking "I want one, I want one." Most of us at this time are taking a wait and see attitude. I predict that one of the next big breakthroughs will be a truly low cost mass storage system which will, in all probability, be a floppy disc system, dual drive of course and maybe even dual density. Charge-coupled devices and magnetic bubble memories are still a ways off in the future. Although when these devices do become commercially viable, the hobbiest will benefit. It is an unwritten law that the amateur technology results from the overflow and fallout from commercial technology. Yes, that means that the desk top laser line printer is still way off in the future also.

At the more basic hardware level of the integrated circuits, there are currently more than 36 microprocessor chips available with more planned in the future. Presently, the personal computing field is heavily dominated by Intel's 8080 and Motorola's 6800 microprocessing units, although there are some interesting new types. Notably, Intel's 8048 CPU includes 512 bytes of random access memory in the CPU as well as UV erasable read only memory. Although it has a limited addressing range of 2K it should make a dandy controller. Of more far reaching significance is the new Z80 chip from Zilog. This is a SUPER 8080 that is software compatible with 8080 systems. However, the Z80 goes beyond where the 8080 leaves off. The twelve unimplemented operation codes of the 8080 instruction set have been used, and in some cases, result in four byte instructions. Altogether, with variations, there are over 700 Z80 instructions which should be enough to make even the most stout hearted assembly language programmer go completely bananas. Additionally, there are twice the number of internal registers and an index register that allows true relative branching. We know of a Z80 currently being installed in an ALTAIR, which should prove very interesting. I'm sure that we'll hear more about the potential of this chip as time goes on.

Also coming as the logical extension to the programmable input/out chips (PPI's, PIA's, ACIA's) are programmable direct memory access controllers and programmable interrupt controllers. We also predict complete floppy disk formatters and controllers on one chip.

As surely as the sun will rise tomorrow, the day will come when a microprocessor type computer will be as common in most homes as the color TV and stereo are today. It will interface to the telephone, the television, stereo and home climate control systems. It will maintain the household environment, be your complete income tax information file, balance your checkbook, etc. This probably won't happen by 1980, but by 1990 . . . ? The future of personal computing is bound to be fraught with interest and we may be in for a wild ride at times, but if we can survive the pace and changes we will have our reward.

GOOD NEWS FOR THE HARDWARE PURCHASER

Take heart! Big brother may be on our side. The Federal Trade Commission has a new regulation out that applies to mail-order merchants that became effective on February 2, 1976. The rule says that a seller must ship the product purchased within 30 days after receipt of the order or notify the buyer of the delay and offer the option of cancelling the order with a full refund. This notification must not cost the buyer anything, e.i. pre-paid postcard. A non-response from the buyer may be interpreted by the seller as consent to an additional 30 day delay. However, for longer delays express consent must be obtained from the buyer. Indefinite delays are allowed if agreed to by the customer and refunds must be made when requested during such delays.

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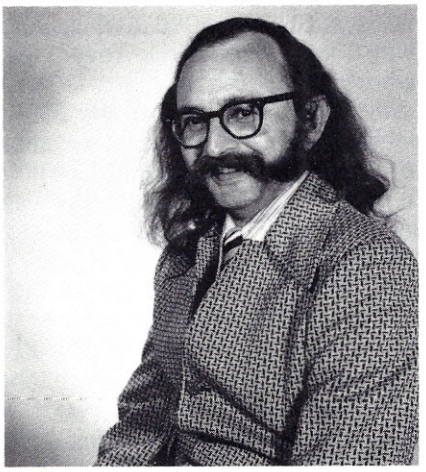
Scott Wilcox
Hardware Editor



The President's Column

A problem has been rattling around for some months concerning software for computer hobbyists—specifically the Basic Language program written for the 8080 microprocessor by Micro-Soft, and marketed by MITS, Inc. A very direct and somewhat heated letter, written by Bill Gates, general partner, Micro-Soft, was sent to every hobby computer publication. It was published in *Micro-8 Computer User Group Newsletter,* Vol. 2, No. 2, February 10, 1976, and in *Computer Notes,* Vol. 1, Issue 9, February, 1976. The letter was headed "An Open Letter to Hobbyists," and contained a most explicit charge that most hobbyists have obtained their software improperly. To support the charge a number of points about the cost and income from Altair Basic are discussed. Mr. Gates is greatly distressed that a major investment in the hobby market has produced a minor return because of alleged violations of the law. It distresses me that such a sweeping accusation of wide spread piracy has not resulted, to my knowledge, in one single conviction. In my limited understanding of the laws of this nation, I believe the concept of "innocent until proven guilty" is still in force. I also believe that an individual or group wrongfully accused has some right of redress. As the elected president of this Society, I must totally and completely deny the charge. In an age where honor and integrity seem obsolete, we will insist that honor and respect be accorded to each and every member.

If we can now turn down the heat, possibly some light could be shed on the problem. The general direction of SCCS in the software area is toward a program library that would be distributed as widely as we possibly can at the most minimal cost to the user. We are considering a plan of "branch" repositories that would reproduce and distribute on a local basis. *Any* and all software distributed by SCCS would be in the public domain. No licensing or royalties would ever be charged. We would acquire programs by any and all legitimate means. If a program were of sufficient value to a large enough segment of our membership, we could consider commissioning the development of it for the Society. Clearly an 8080 Basic is of that nature and Mr. Gates' program is of that quality. The idea I would like to explore is how we might properly make an 8080 Basic freely available to everyone.

First, we might launch an internal effort based on a committee of 8080 users, and exploit the technical expertise within the Society. This is very much in keeping with our pioneering spirit and our willingness to attempt Herculean tasks.

Second, we could encourage all manufacturers of 8080 machines to develop Basic and place it in the public domain. This would be a most significant contribution and would not go unnoticed by any hobbyist or publication.

Third, we could solicit proposals to develop our own version of Basic, and if necessary, ask for contributions to help fund it. Obviously Mr. Gates and Micro-Soft are in the strongest competitive position, having already demonstrated their capability. This might cause a severe conflict since MITS, Inc. is marketing the existing Basic, apparently on an exclusive basis. I am given to understand that MITS, Inc. is only breaking even on the sales after paying royalties, so would it be to their advantage to have a royalty-free Basic? Since Micro-Soft asserts that piracy has destroyed the ssalability of their program, are the residual rights for sale?

Now comes the difficult question of fairness to Mr. Gates. In expressing our goal of a Public 8080 Basic we have probably encouraged a wait-and-see response in potential customers. Further we have said to Mr. Gates' alleged thieves, "You may be home free." Again, I doubt that there are any thieves. Finally we have done some disservice to those who have already purchased Basic. It is an unfortunate, but inevitable problem in the computer field where sudden price decreases are more the rule than the exception. In the long run I hope this incident may have a positive result to all concerned. There have been many problems between hobbyists and manufacturers for many reasons. To insure the future we must try to find sound responsible solutions. Surely the prestige of Micro-Soft as the leading producer of hobbyist software is secure and their intent is not to declare war on the hobbyist. Nor is it our intent to harass MITS, who is caught in the middle. Their premier position in the industry was attained by hard work and dedication. If none of us had been sucessful, we would have none of these problems. If we can not resolve them we will be replaced by those who can.

The time to start is *now.*

Respectfully,
Ward Spaniol

APPLICATIONS vectored from . . . pg. 32
character. It would be desirable, then, to use the incoming serial bit stream to generate an interrupt in order to indicate the beginning of a character. This can easily be accomplished by inverting the data input and connecting it to the interrupt input. If this is to be the only interrupt, no buffer will be required. The start bit will always be longer than it takes to be recognized and it will be gone by the time the complete character is read. This means, however, that interrupts cannot be enabled until after the entire word is input—including stop bits. The complete serial communication routine that has been developed will operate in an interrupt mode but the overhead instructions for processing the interrupt must be included. That is, the PUSH and POP instructions must be incorporated.

If it is impractical or undesirable in your system for the microcomputer to generate the necessary timing signals for serial data communication, you may have to add a UART or USART (Universal Synchronous/Asynchronous Receiver/Transmitter). In this application, the hardware handles the parallel-to-serial and serial-to-parallel data conversions. These are two ways for the program to respond to such a device: polling and interrupts. Polling requires the program to periodically interrogate the status word of the USART to determine if there is an incoming character available or if another output character can be accepted. Using interrupts, these two status conditions are gated into the interrupt logic. Vectored interrupts can cause the microprocessor to directly jump to the appropriate input or output function. single level interrupts merely require that the status word be read to determine which function caused the interrupt.

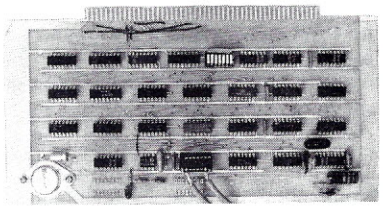
With the use of a USART like the Intel 8251, it is not necessary to add any buffer to the interrupt logic since the status bits are latched within the device and are automatically reset whenever data is transferrred.

Summary

I have demonstrated, in the last few application articles, how the microcomputer can be used effectively in many types of applications. Applications commonly designed with hardware can often be replaced, or at least simplified, by the use of microcomputers. These articles have shown how to use the microcomputer to time events which are both internal and external to the microcomputer system. The tradeoffs between the use of hardware and software have been discussed and will, hopefully, enable you to effectively use microcomputers in many future applications. The goal of the application series was to inform, educate, and above all, stimulate your interest in other areas of microcomputer applications. If there are other application topics you would like to have discussed, send an "interrupt" to the editor. ◻

CALCULATIN' vectored from . . . pg. 37
from cams in the base. And you talk about your pet rock! By golly, this was analog memories gone rabid!

So don't knock calculatin' devices using analog or digital memories, nor read only memories with birds attached. Some folks even attached fake people. Look at what memories have done for Disneyland. If you can, see Abe Lincoln there; he has a great memory. ◻



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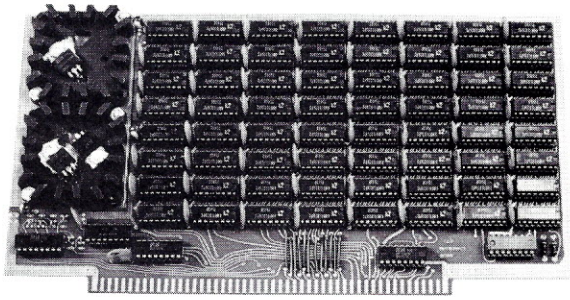

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SYSTEMS vectored from . . . pg. 48

So, after we have examined these three major languages, what is the best language? It is obvious that BASIC has advantages. So do FORTRAN and PL/1. It really depends upon what one is considering. If you consider ease of writing, BASIC offers the best alternative. Perhaps mathematical precision is your priority, and if so, FORTRAN or PL/1 offers a good environment. If you want a combination of FORTRAN and BASIC without the widespread availability of both, then PL/1 is your answer.

Most, if not all large scale systems can support many users. There have been many Star Trek programs written, but none that I have seen are really utilizing the resources that the large scale system offers. If anyone has either written a program, or has access to one designed for large scale systems, you might consider sharing it with readers of INTERFACE. Send your offerings to me c/o the editor and we'll try it out. ◻

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EXCHANGE vectored from . . . pg. 10

Bob also *heartily* recommends a book entitled *Biofeedback and the Arts,* edited by David Rosenbloom. It reports on work done by artists, dancers, musicians and biofeedback researchers regarding biofeedback in relation to aesthetic experiences. This book is also available from PCC, priced at $12.95. I haven't seen it, but would like to hear from others who have. Bob also assured me that he is still planning to have a biofeedback section in PCC, so look for it.

ALTAIR COMPATIBLES AVAILABLE

I received a catalog from Scientific Research Instruments, P.O. Drawer C, Marcy, New York 13403. They have a line of ALTAIR compatible kits which are oriented towards processing analog data—an A/D converter, a real time input module, temperature and sound sensors, and an input multiplexor. I guess that their ALTAIR is suffering from a case of sensory overload, because they also have a super CPU kit on the drawing board. They predict a 72 bit word length and a 60 ns add time for under $1,000. They don't say anything about memory to keep up with this CPU or about its architecture, but if you are into things like graphics, pattern recognition, etc. you might contact these guys. They also sell software—fairly standard programs for business, engineering, math, games . . . but the prices seem out of line.

That's all for this month—if you have something of interest, pass it along. ◻

UPDATE vectored from . . . pg. 6

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Each month SCCS Interface will devote some space free, non-commercial advertising by members. This is done as a service to members of the Southern California Computer Society and to help promote communications between computer experimenters and hobbyists throughout the world.

Many SCCS members, being pioneers in the small computer field, often have for sale, on an occasional basis, used computing equipment, or equipment they have designed and built themselves. Those members, as well as those who simply wish to establish contact with individuals with similar or complimentary interests are encouraged to utilize the member ad privilege subject to the following conditions:

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Address all member ads to: Interface Ad Editor, Nancy DeLong, 8005 Denrock Ave., Los Angeles, Calif. 90045

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FOR SALE: one PTCO. 2K EPROM board with 16-1702A's (total 4K), $150/offer; INTEL 8214 PICU, $17; MM5320 video timing chip, $15; XR210, $3.50; Want paper tape reader and/or punch; Need info on NOVAR Acoustic Coupler sold by SSM. Glenn Nelson, Box 1846, Brown U., Prov., RI 02912. (401) 274-5794.

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If you thought a rugged, professional yet affordable computer didn't exist,

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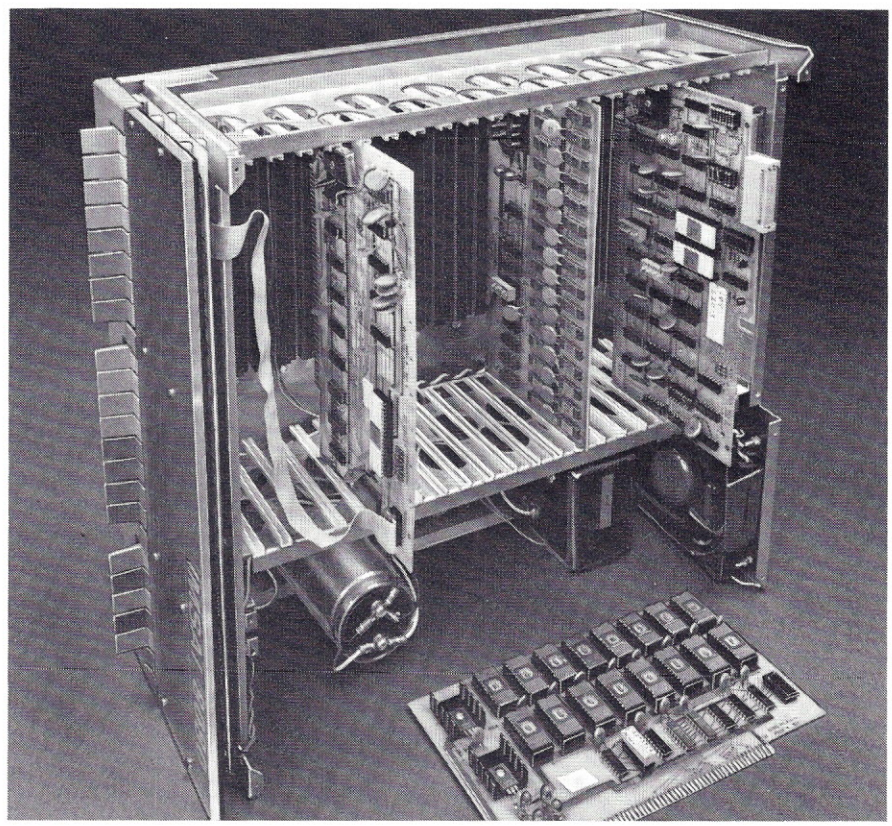


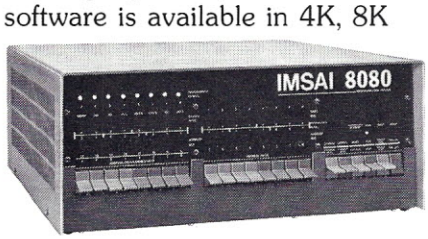
Sure there are other commercial, high-quality computers that can perform like the 8080. But their prices are 5 times as high. There is a rugged, reliable, industrial computer, with high commercial-type performance. And prices that are competitive with Altair's hobbyist kit. The IMSAI 8080. Fully assembled, it's $931. Unassembled, it's $599. And ours is available now.

In our case, you can tell a computer by its cabinet. The IMSAI 8080 is made for commercial users. And it looks it. Inside and out! The cabinet is attractive, heavy-gauge aluminum. The heavy-duty lucite front panel has an extra 8 program controlled LED's. It plugs directly into the Mother Board without a wire harness. And rugged commercial grade paddle switches that are backed up by reliable debouncing circuits. But higher aesthetics on the outside is only the beginning. The guts of the IMSAI 8080 is where its true beauty lies.

The 8080 is optionally expandable to a substantial system with 22 card slots in a single printed circuit board. And the durable card cage is made of commercial-grade anodized aluminum. The Altair kit only provides 16 slots maximum in four separate sections, each section requiring 200 solder connections.

The IMSAI 8080 power supply produces a true 28 amp current, enough to power a full system. The Altair produces only 8 amps.

You can expand to a powerful system with 64K of memory, plus a floppy disk controller, with its own on board 8080–and a DOS. An audio tape cassette input device, a printer, plus a video terminal and a teleprinter. These peripherals will function with an 8-level priority interrupt system. IMSAI BASIC software is available in 4K, 8K and 12K, that you can get in PROM. And a new $139 4K RAM board with software memory protect.



Find out more about the computer you thought didn't exist. Get a complete illustrated brochure describing the IMSAI 8080, options, peripherals, software, prices and specifications. Send one dollar to cover handling to IMS. The IMSAI 8080. From the same technology that developed the HYPERCUBE Computer architecture and Intelligent Disk systems.

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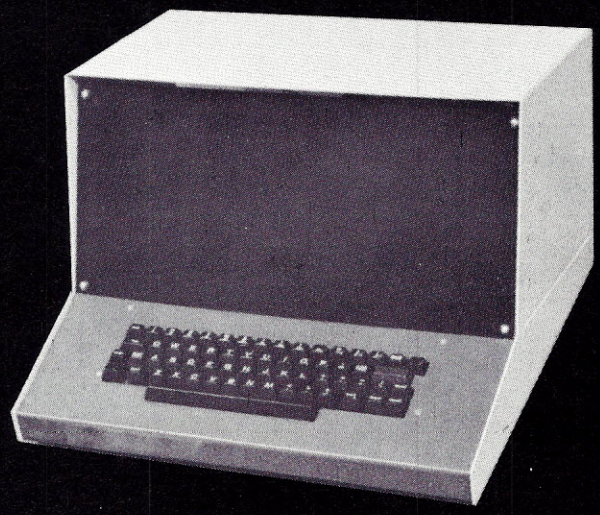

...we disigned our computers for people like you who are interested in having one, but up 'til now didn't have $30 or $40 thousand to put into one. It is all together in one package now, thanks to advanced technology and the good ole american spirit of doing it faster, better, and cheaper than the other guy.

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We have a Program Development System (PDS) that is an aid to programming. What an idea! It remembers its job even when the computer is off. With instant call-up of the program outline when the power is turned on. There is an Editor, an Assembler, and a Debugger to help you do your programming correctly, and quickly, leaving you a lot more time to actually use the computer as a data handler... and **THAT'S A PLEASER.**

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